REPORT

OF

WALTER SHANLY, ESQUIRE,

ON

THE OTTAWA SURVEY.

SUBMITTED TO THE LEGISLATIVE ASSEMBLY, FOR THEIR INFORMATION.

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REPORT

Of Walter Shanly, Esquire, on the Ottawa Survey. Submitted to the Legislative Assembly for their information.

T. J. J. LORANGER,
Secretary.

Secretary's Office,
Toronto, 30th July, 1858.

Toronto, 22nd March, 1858.

Sir,—I have the honor to report on the proposed line of navigation from Montreal, by the Ottawa and French River, to Lake Huron, the examination and survey of which were committed to my charge by the Commissioners of Public Works, in July, 1856.

As an Index to the work embraced in the exploration and survey of so long and varied a chain of waters as go to make the route in question, I will divide it into the following sections:

1st. Montreal to Ottawa City	110	miles.
2nd. Ottawa to Portage du Fort	55	"
3rd. Portage du Fort to Fort William	60	"
4th. Fort William to Mouth of the Matawan	80	"
5th. The Matawan and Lake Nippisingue	45	"
6th. Lake Nippisingue and French River	80	"
Whole distance Montreal to Lake Huron	430	miles.

For particulars of the steps taken for the carrying out of my instructions I would refer you to my *ad interim* reports—more especially those of the 13th December, 1856, and 19th March, and 25th August last year, while I will here merely recapitulate in general terms what in those documents is given in detail, viz.: that the original appropriation for meeting the expenses of the survey having been of very limited amount, I deemed it advisable to confine actual instrumental operations in the first instance, to those portions of the route which obviously presented the principal obstructions to the establishment of a continuous navigation. The sections selected on these grounds were;—1st. That from Portage du Fort, at the head of the Chats Lake, to the foot of the noble stretch of navigable water above Fort William, known as the "deep river,"—being No. 3 in the above index;—2nd. From the mouth of the Matawan to Lake Nippisingue, No. 5, in index.

The first described division, covering some sixty-five miles of the length to be explored, is by far the most obstructed portion of the main Ottawa River, and consequently the most tedious of survey, as it will eventually be the most costly of improvement, when placed in comparison with any equal portion of the route

above Bytown. A complete and reliable survey of this section, I deemed indispensable to a correct knowledge of the capacity of the Ottawa as a navigable highway to the west.

That an accurate chart of the Matawan, and a reliable topographical map of the dividing ridge between it and Lake Nippisingue, was equally indispensable to a correct solution of the problem with which I have to deal, must necessarily have struck any experienced engineer, who had at all given his attention to the subject, that question involving a matter of no lesser moment than the connection, for purposes of commerce, of the waters of the great Ottawa River with those which chose their path to the Ocean by way of the Great Lakes and the Falls of Niagara. It must have been obvious, also, even in the absence of any previous knowledge of its *contour*, that in the region of the Matawan, would have to be decided the all important question of the supply of water to meet the exigencies of lockage.

From the confluence of the Matawan with the Ottawa to the mouth of the little "Rivière des Vase" on Nippisingue, is forty-five miles.

The surveys of these two divisions of the projected chain of navigation were commenced in August, 1856, and carried on uninterruptedly, all through the severe winter that ensued, particularly severe as it must necessarily ever be in the northerly latitude in which they lie. Operations on the Matawan were continued until the following May, when I received official instructions from you that the two parties of engineers there engaged were to be called in, and that portion of the survey abandoned, or suspended *sine die.* Those instructions I acted upon at once, though with reluctance, for the work had been approached so near to completion that three months continuance of even one of the parties in the field would have secured all the requisite data for the compilation of a finished and accurate chart of that singular and interesting river as well as of the adjacent shore of Lake Nippisingue.

The lower division of the work, from the Deep River to the head of Chats Lake, continued under survey until the end of January last, shortly previous to which time you notified me that it had been decided by the commissioners, acting under an order of His Excellency the Governor General in Council, to discontinue all further operations for the present.

It is much to be regretted, if I may be permitted to say so, that the necessity for the suspension of this survey should have arisen just when it did, at a period of the year when the ice affords such facilities for sounding with accuracy and expedition, and for obtaining the other necessary data for finished and comprehensive maps and charts, and which on the rugged and precipitous shores of deep waters cannot at any other season be had with equal economy and correctness. The present winter, had the work not been interrupted, would have resulted in the acquisition of the necessary material for laying down with completeness all the varying features of shore line, islands, and depths relating to the several channels into which that intricate section of the Ottawa is divided by the Allumettes and Camulet Islands, and the many little islets between the Grand Calumet Falls and Portage du Fort.

In accordance with the instructions last referred to, the Ottawa survey was totally suspended on the 31st January last. I should have mentioned that in addition to the two divisions of the route above described as compassing my first scheme of operations, I have also succeeded in obtaining a very excellent, though also still incomplete survey of a third division—Lac des Chênes—forming part of section No. 2 in index, and extending from the foot of the Chats Rapids opposite Fitzroy Harbour, to the head of the Chaudière Rapids seven miles above the City of Ottawa.

During my explorations of the Ottawa in November 1856, learning that the works of the Chats Canal were on the eve of being suspended, it struck me that the resident Engineer of that work, Mr. Gallway, thus relieved of his ordinary duties,

might possibly be spared to assist in the important survey which I had then recently commenced. On making such a suggestion to the Department the Commissioners at once responded by placing Mr. Gallway and his party at my disposal; I accordingly requested him to connect, by regular survey, the already commenced canal at the Chats with the contemplated one at the Chaudière.

This work carried on during the winter of 1856–7, though not completed, was prosecuted sufficiently for to furnish a correct outline of Lac des Chênes, and to add twenty-seven miles, (the length of the lake) of correct soundings to our store of information respecting the available depth of the waters under examination.

From the moment of assuming the responsibility of ascertaining and pronouning on the merits of so bold a project as that of opening an entirely new ship or steamer communication between the Lower St. Lawrence and the Lake ports of the West, I laid down the principle of having the work executed with the greatest possible carefulness and accuracy, desirous (as stated in a former report) of producing charts of our grand northern river as reliable in every particular as those admirable ones which will ever associate the name of Bayfield with the Great Lakes and the St. Lawrence.

I accordingly adopted the trigonometrical system of survey, and as far as the work has gone, no pains have been spared to insure correctness, as well in determining the shore line of the waters, main lands, and islands, as in laying down the soundings.

The following summary, taking the sections which were under survey in the order in which they occur ascending the Ottawa, will serve to show at a glance what proportion of the route has been submitted to the test of instrumental examination, the whole distance from Montreal to the mouth of the French River being, as already stated, estimated at 430 miles.

1st.	From the Chaudière to the Chats Rapids, "Lac des Chênes"..	27 miles.
2nd.	From Portage du Fort to the Deep River.....	65 "
3rd.	From mouth of the Matawan to Lake Nippisingue	45 "
	Total.....	137 miles.

The triangulation of all these sections has been nearly completed, but a large amount of field work, as has been before mentioned, remains to be done in order to complete the tracing in of the shore lines, and the topography of the banks of the rivers and lakes. Soundings have been taken throughout, generally at intervals of two hundred feet apart, save in the actual rapids and some isolated spots besides, where the waters did not freeze. The results of this department of the work may be briefly summed up as follows:

1st. *Lac des Chênes.*—For about three-quarters of a mile below the foot of the Chats Canal we have a series of rocky bars and shoals, which scarcely leave, at low water, a depth of more than seven and a half feet available for navigation. There is, however, much deep water (over fifteen feet) in that distance, and the formation of a channel twelve feet in depth or more, though it would involve considerable outlay, is perfectly within the scope of practicability. The remainder of Lac des Chênes, twenty-seven miles, has a broad, direct channel, with a minimum depth of twelve feet at low water, the average soundings being more than twenty feet, and but one fortieth part of the whole distance less than fifteen feet.

2nd. The section from Portage du Fort to the Deep River, 65 miles, has been sounded throughout the northerly channel of the river, including Lac Coulonge, and presents generally an available depth of over fifteen feet, by far the larger proportion of the distance having soundings of more than thirty feet. In the Calumet Channel, from the head of the island of that name to the Grand

Calumet Falls, seventeen miles, we have some ten miles of shallow water, from six to nine feet, over shoals composed of sand or alluvial deposit. The water in this channel can, by the simple construction of an easily formed dam at the Falls, be kept up permanently to a level that would, without damaging any lands now available for cultivation, give a minimum depth throughout of nine feet, and a channel of twelve, or for that matter, fifteen feet in depth, can then easily be obtained through the shoals by dredging out from two to six feet of the soft deposit of which the bottom is composed.

3rd. The soundings of the Matawan River are highly satisfactory, extending, save in the few cases of "open water" (nearly all soundings having been taken from the ice), from its confluence with the Ottawa to its head waters in the upper extremity of Front Lake, distance 42 miles. In mid channel the depths average as follows:

15 feet and over	32 miles.
12 " and less than 15	5 "
10 " and under	5 "

Of the deep portions, that is to say fifteen feet and over, three-fourths, or twenty-four miles, have more than 30 feet soundings. In "Lac Plein Chants," a stretch of smooth water five miles in length not far above the mouth of the river, the average depth is more than eighty feet; in many instances bottom not being discoverable with three times that length of line.

Lac "Talon," which we reach at eighteen miles from the mouth, and which gives us eight miles of still water, is also very deep, never less than twenty (20) feet in mid channel and commonly more than one hundred feet. We then come to La Tortue and Trout Lakes, twelve miles more of smooth water. In the former the minimum soundings are fifteen feet, in the latter thirty, while frequently more than two hundred feet are found.

Apart from the regular surveying operations, Mr. Stewart, my principal assistant in the work, took advantage of the good ice in the winter of 1856–7, to ascertain the depth to be depended on in the Chats Lake (the upper part of section No. 2 in Index) from Portage du Fort to within three miles of the head of the Chats Canal.

Consecutive and close soundings were taken throughout that length, some seventeen miles, except for about two-thirds of a mile of open water at the Chenaux Rapids and resulted in showing a minimum depth of about fourteen feet, the soundings generally ranging between thirty and sixty feet, while the lead at the end of thirty fathoms of line, frequently announced "no bottom."

I have thus had soundings taken over about one hundred and fifty miles of the proposed chain of navigation, upwards of one-third of the whole estimated length, and in that distance find only some thirty miles (including the Chats Canal) requiring artificial improvement to render each section continuously navigable in itself for vessels drawing twelve or even fifteen feet of water. As I proceed with this report I trust to be able to show that, following the route of the waters proposed to be improved from Bytown to the Georgian Bay, the points between which my whole field of operations lay, there are at least one hundred and twenty miles more of deep and level water, in detached sections it may be, but requiring little or no aid from the hand of man to render them amenable to the purposes of ship navigation.

The falls and rapids of the surveyed and other portions of the route will be touched on by and by when I come to enter on the general engineering features of the whole scheme, and will in that connection be exhibited in tabular form as an appendix to this report.

Besides the hydrographical examinations embraced in the foregoing summary

of soundings, a survey has been also made of the ridge of land dividing Trout Lake, at the head of the Matawan River and the most westwardly of the waters tributary to the Ottawa, from Lake Nippisingue, whose outlet is by the French River to Lake Huron; and the topographical features of the barrier between where the waters of two of the mightiest of American rivers approach almost within rifle shot of one another, have been ascertained with sufficient accuracy to enable me to pronounce with confidence on the practicability and probable cost of uniting them.

Having sketched, as above, my course of proceedings towards the discharge of the trust committed to me, I will next, before entering on consecutive details as to harborage and lockage, distance and depth, exhibitory of the engineering characteristics of the route, endeavor to give, for the information of those who, though interested in the project, may not be familiar with the geography of the proposed line of communication, a descriptive outline of the chain of waters which are to form the Ottawa and French River navigation.

The great Ottawa River, which at the foot of the island of Montreal becomes finally merged in the greater St. Lawrence, has a north-westwardly course of probably some five hundred miles, and may be said to drain all that portion of the area of Canada comprised between latitude 45° and 49° and longitude 74° and 79½°.

Following the course of this great artery for about three hundred miles from Montreal, and noting in that distance many large streams pouring into it from both sides, we come to a broad, deep river, having an ascending course to the west. This is the Matawan, the widest and deepest of the western tributaries of the Ottawa. Turning out of the main river, we follow up this branch directly towards the setting sun, for a little over forty miles, when, far larger at its sources than at its mouth, the Matawan closes abruptly at the head of a deep lake, and, for the first time since starting upon our journey, the waters seem to come to an end.

Landing, however, and crossing a sandy ridge, but little elevated above the level of the lake just spoken of, a walk of scarce three quarters of a mile brings us upon a little river, when the current, which has hitherto impeded the progress of our bark canoe, now assumes a contrary direction from that of the waters we have left behind, and is gliding silently but surely to the west.

Descending this stream, known to the "Voyageurs" as "La Rivière de Vase," five miles of canoeing over its gradually widening surface brings us upon a noble expanse of water, Lake Nippisingue, across which, still keeping on our due west course, we find thirty miles of deep water ere again compelled to take the land, which we do near where the dark waters of the lake are seen to hurry tumultuously to some destined goal below through a narrow channel cut perpendicularly in the hard granitic rock. Here a "portage" of scarce a quarter of a mile in length brings us once more to navigable water, and our canoe floats securely on the placid surface of the French River, following whose deep and beautifully terraced waters, and making three short "portages" in its length of fifty miles, we emerge upon the Georgian Bay, having travelled, as near as may be, four hundred and thirty miles from our starting point at Montreal, and to reach which place of union with Ottawa waters, those of the French River, which have just borne us out upon Lake Huron, have a journey before them of not less than one thousand miles, forming an atom in the huge volume of water that takes the great leap of the cataract of Niagara.

With so unbroken a chain of water communication, river and lake, between the lower St. Lawrence—the natural portal of Canada—and the "land of promise" in the west, it is not to be wondered at that the route we have just come over should have been the earliest highway of Canadian commerce.

In the year 1615 a brave Frenchman ascended the Ottawa from where the City of Montreal now stands, and under the guidance of his allies from among the Indians who there swarmed on its banks, as well as on the now desolate shores of Lake Nippisingue and the French River, he followed the identical course that has been traced above, extending his explorations far down Lake Huron. Lake Huron was thus the first of our wonderful fresh water seas ever gazed upon by European eyes, ere yet the thunders of Niagara had greeted European ears. The name of the gallant voyageur was Samuel Champlain.

Impelled by the love of adventure, or the temptations of traffic, La Salle and others quickly followed in the footsteps of Champlain, and for a long series of years, up to a comparatively recent period, large fleets of canoes richly laden with the peltries of the north periodically, year by year, ascended the French River, and, crossing over Nippisingue and the "height of land," dropped down the Ottawa to Montreal, the head-quarters of the fur trade.

Owing to the falling off in that important branch of commerce, in part because of the gradual decrease in the number of fur-bearing animals in the region of Nippisingue and the Ottawa, in part because of the opening of other channels of communication, but, above all, to the appearance of steamers on the great Lakes and of Railways on their borders, the French River and Ottawa route fell into gradual disuse, save as regards the latter river, for the purpose of the timber trade; and on the French River, Lake Nippisingue and the Matawan, whose echoes formerly resounded at not unfrequent intervals to the song of the voyageurs; their cheery voices are now but seldom heard, the only inhabitants of their solitary shores consisting of some few dozen Indian families of that self-same Algonquin tribe of whom hundreds gathered wondering, round the "white men," when, nearly two centuries and a half ago, Champlain and his companions first appeared among them.

In reviewing the commercial bearings of the project under consideration, it must be apparent to the most indifferent looker-on, if he will only give the subject his serious attention for a little, that the claims of such a route as has been described—water, it may be said, the whole way, and nearly four hundred miles shorter between tide water and Lake Michigan than that by the great Lakes, are at all events deserving of an impartial hearing. Setting aside, therefore, the engineering obstacles to be overcome, and which, for argument sake, we will suppose to be smoothed over in the meantime, I will proceed to state the case as simply and briefly as I can for the consideration of the merchant.

It is not my intention to array great columns of statistics to show what the possible trade from the west to the seaboard may be some ten years hence, within which period such a navigation as is above foreshadowed may become a reality. The increase of population and commerce in the western States and western cities has invariably outstripped the anticipations of the theorist, and are perfectly certain to continue to do so for a long series of years to come.

It would be almost in vain, then, to speculate on what the next ten years of progress should bring forth; but it may fairly be asserted that producing powers in the west, and demand for its products in the east, are increasing in such rapid ratio that any project which shall have for its end to diminish space and increase the facilities of transport by water carriage, will find such favor in the eyes of the mercantile community that the restless spirit of commerce will neither slumber nor sleep while a possibility remains of effecting some radical improvement in the water communication between the lake ports of the interior and the sea ports of the Atlantic coast. Millions will be freely contributed and freely expended for the furtherance of such a purpose ere ten years more have passed away.

The natural outlet of all that fertile region east of the Mississippi which

drains into the great Lakes, is, of course, their outlet the St. Lawrence; and the preponderance of the trade of that immense area, as it assumes dimensions proportioned to the vastness of the river, will settle into that channel as a matter of destiny. No wholly artificial revenue can keep pace in increasing capacity with the gigantic commerce which is growing up to the west of Lake Michigan, and which will force us Canadians into bolder undertakings than any we have yet embarked in. Canada lies directly across the leading route from the far west to the Atlantic seaboard, and over some portion of our territory the great tide of western commerce must for ever roll.

To meet the coming exigencies of that commerce, public attention has already been directed to three great projects, viz:

1st. The enlargement of the Welland Canal.

2nd. The construction of the Toronto and Georgian Bay Canal.

3rd. The establishment of the French River and Ottawa navigation.

I use the term navigation rather than canal in relation to the last named scheme, because, as before observed, it consists of an almost uninterrupted chain of waters—river and lake—demanding, just as we all remember the St. Lawrence did, certain detached sections of canal to render the navigation continuous.

The maps accompanying this Report will place clearly before the reader the relative geographical positions of each of the routes named. That by the Welland Canal is so familiar to all in any way concerned in the trade of the lakes that the name is sufficient to recall its importance and success. The enlargement to ship proportions of that indispensable connection between Lake Ontario and the upper Lakes will be the first accomplished of any of the three projects under consideration.

With respect to the Toronto and Georgian Bay Canal, the lately published and elaborate report of Mr. Kivas Tully, Civil Engineer, puts us in possession of full and reliable data as to the constructive features of that project, while my own explorations and partial surveys in connexion with project No. 3 enable me to condense its salient features into tabular comparison with those of its compeers:

No.	Name of Route.	Distances Chicago to Montreal.				Lockage.		
		Lake.	River.	Canal.	Total.	Up.	Down.	Total.
		Miles.	Miles.	Miles.	Miles.	Feet.	Feet.	Feet.
1	Welland Canal	1145	132	71	1348	..	535	535
2	Toronto and Georgian Bay	775	155	120	1050	130	675	805
3	French River and Ottawa	575	347	58	980	83	615	698

From these figures it appears that in point of distance, No. 3, which may be termed, *par excellence*, the "Canadian route," hold a very wide advantage over No. 1; and, though possessing in a lesser degree a similar advantage over No. 2, is so far its superior in regard of lockage, as *cæteris paribus*, to entitle it to at least an equal share of attention.

In the foregoing table, Chicago is taken as our point of departure from the west, Montreal as the port of destination; with these points as termina, I will endeavor to show what the relative cost of transportation by each of the three routes should be, and to that end will avail myself of the calculations of the net mileage cost of transport by the several descriptions of water carriage, lake, river, and canal, given us in the able report of Mr. W. J. MacAlpine, on the canals of the State of

New York. I also ask permission of Mr. J. B. Jervis to make use of some of the figures relating to similar matters set forth in his excellent treatise on the Caughnawaga Canal project.

The following is Mr. McAlpine's table .—

TABLE OF THE COST OF TRANSPORT PER TON PER MILE.

Ocean.	Long voyage	1 mill.
"	Short "	2 to 4 mills.
Lake.	Long "	2 "
"	Short "	3 to 4 "
Rivers.	Hudson and of similar character	2½ "
"	St. Lawrence and Mississippi	3 "
"	Tributaries of Mississippi	5 to 10 "
Canals.	Erie enlargement	4 "
"	Other large Canals but shorter	5 to 6 "
"	Erie Canal, ordinary size	5 "
"	With Great Lockage	6 to 8 "
Railroads.	Transporting Coal	6 to 10 "
"	Not for Coal, favorable grades and lines	12½ "
"	Steep Grades	15 to 25 "

To the Canal rates above given must be added the tolls, which, on the Erie Canal in its present unenlarged condition, swell the cost of transport through it to about 14 mills per ton per mile, Mr. Jervis making just allowance for the lessening of tolls certain to be a consequence of the increase of tonnage due to the larger capacity of our Canadian canals, when tested to their full capability, and for the actual decrease in the cost of transportation due to the larger class of vessels that their capability will admit of being employed in the trade, assumes the cost of transport, tolls included, in ship canals of ordinary cost, at 8 mills per ton per mile, which is simply adding 4 mills for toll to Mr. McAlpine's 4 mills for transport.

Mr. T. C. Clarke in his excellent paper on the " Avenue of Western Trade," first published in " Hunt's Merchants' Magazine," and subsequently in the Report of the Commissioner of Public Works for last year, assumes, and justly, that the cost per mile of both the " Toronto and Georgian Bay," and " French River and Ottawa " Canals, will be far in excess of the average cost of the magnificent canals we can now boast of; and that, as a consequence of such increase of outlay, there would naturally be a corresponding increase of tolls,—estimated by him at double the ordinary rate,— which, however, he puts at 5 mills per ton per mile, against Mr. Jervis' 4 mills. Accepting Mr. Clarke's principle as sound, I adopt Mr. Jervis' figures, though for the purposes to which I am about to apply them, that of comparison, the one rate would answer fully as well as the other. Taking, therefore, Mr. McAlpine's rate of 4 mills as the nett cost of transport in large canals and doubling Mr. Jervis' tollage of 4 mills, we have 12 mills as the cost of transporting a ton of goods through each mile of the two costly canals with which I have to deal in comparing them as channels of trade with the Welland and other artificial links in the St. Lawrence line of navigation.

The several routes will then compare as follows:

1st. *Welland and St. Lawrence Canals.*

Lake navigation	1145	miles at	2	mills	$2.29
River "	132	"	3	"	0.40
Canal "	71	"	8	"	0.57
					$3.26

2nd. *Toronto and Georgian Bay Route.*

Lake Navigation,	775	miles at	2 mills	$1.55
River "	155	"	3	0.46
Canal (T. & G. B.)	77	"	12	0.92
Canal (St. L.)	43	"	8	0.34
				$3.27

3rd. *French River and Ottawa Route.*

Lake Navigation,	575	miles at	2 mills	$1.15
River "	347	"	3 "	1.04
Canal "	58	"	12 "	0.70
				$2.89

In the foregoing calculations I have assumed Mr. MacAlpine's minimum rate for lake carriage and his maximum for large rivers, so that the comparison cannot be charged with being unduly favorable to the Ottawa route, which is represented as possessing a very much less proportion of lake and far more of river navigation than either of the other two, although much of what in it I have classed as river might justly be put down as lake, fully one-fourth the distance assigned to the former category having width and depth sufficient to admit of half a dozen vessels as big as the " Leviathan " running side by side.

I will now submit a comparative statement of the time to be occupied in an ordinary voyage over each of these routes, choosing the propeller as the description of vessel with which to experiment in tasking their respective merits in that particular, and will suppose three such vessels, of equal capacity in every respect, to clear from Chicago at the same time, all three having their manifests made out for Montreal. They sail together past the straits of Mackinac till abreast of the lower end of the Great Manitoulin Island, when, one of them keeping on a nearly due south course down Lake Huron, for the Welland Canal, the other two steer eastward, and in company, till, clearing Cape Hurd, they enter the Georgian Bay, one of their heads northward for the French River, to take the Ottawa Route, the other south-wardly to Nottawasaga, the entrance of the Toronto and Georgian Bay Canal.

I will assume for the rate of progress of all three vessels eight miles per hour through lake and river, three miles per hour in canal, and will allow one and a half minutes for each foot of lockage.

With these conditions the time occupied in the several trips should prove as follows:

1st. *Welland Canal Route (enlarged.)*

1277 miles Lake and River Navigation	159 hours.
71 " Canal "	24 "
535 feet Lockage	13 "
Chicago to Montreal	196 hours.

2nd. *Toronto and Georgian Bay Route.*

930 miles Lake and River Navigation	116 hours.
120 " Canal "	40 "
805 feet Lockage	20 "
Chicago to Montreal	176 hours.

3rd. *French River and Ottawa Route.*

915 miles Lake and River Navigation	115 hours.
58 " Canal "	19 "
698 feet Lockage	18 "
	152 hours.

Difference in favor of No. 3 over No. 1 ..... 44 hours.
Do. do. No. 3 over No. 2 ..... 22 "

To render the comparisons more comprehensive we will now retrace our steps from Montreal to the foot of Lake St. Louis, and supposing the Caughnawaga Canal to be *un fait accompli*, will take our propellers and their cargoes by that route, Lake Champlain and the Hudson, to New York. The cost of transporting a ton of goods from Chicago to New York will then compare as follows, the Champlain Canal being assumed as enlarged to ship proportions, and the Hudson improved for large vessels up to Waterford ten miles above Albany.

1st. *Welland Canal Route.*

Chicago to Caughnawaga as above, deducting Lachine Canal charge				$3.19
Caughnawaga Canal	33 miles at	8 mills	$0.26	
St. Johns to Whitehall, river & lake,	120 "	3 "	0.36	
Champlain Canal	65 "	8 "	0.52	
Hudson River, Waterford to New York	155 "	2½ "	0.39	
				1.53
Chicago to New York, 1721 miles				$4.72

2nd. *Toronto and Georgian Bay Route.*

Chicago to Caughnawaga, as above	$3.20
Caughnawaga to New York, do	1.53
Chicago to New York, 1423 miles	$4.73

3rd. *Ottawa and French River Route.*

Chicago to Caughnawaga, as above.....	$2.82
Caughnawaga to New York	1.53
Chicago to New York, 1353 miles	$4.35

The foregoing calculations should be sufficient, I think, to show that the French River and Ottawa line of navigation possesses in reality such commercial advantages as make it worth while to put its engineering merits on their trial, I will therefore proceed to set forth the difficulties to be encountered, and the facilities for dealing with them, in grappling with what must undoubtedly prove a stupendous undertaking, and in doing so I shall confine myself strictly to the facts elicited in the course of my explorations and surveys, "nothing extenuating wherein they are worthy," and vouching for the correctness of my premises, shall cheerfully abide the criticisms of my professional brethren upon the conclusions I arrive at.

ENGINEERING FEATURES OF THE ROUTE.

I commmenced my examination at Penetanguishene, and made a careful reconnoissance of the eastern coast of the Georgian Bay, from thence to its most northerly indentation, the French River. Ascending which stream I noted all its capabilities for the purposes of a ship navigation; and continuing my route across Lake Nippisingue explored its coasts and inlets, crossed over the ridge of land separating its water-shed from that of the Ottawa, descended the Matawan River, and so on down the Ottawa to the foot of the Grand Calumet Falls; making a canoe voyage of nearly four hundred miles, and satisfying myself by personal observation that the plan of operations previously adopted, and herein already described, was that best calculated for the proper carrying out of my instructions.

Previous to setting out upon my explorations I had endeavoured to gather

such reliable information as was within my reach relating to the characteristics of the route generally, but more especially as regarded that important point, the

TERMINAL HARBOR ON LAKE HURON,

And ascertained that the prevailing opinion with respect to the entrance of the French River was not favorable to the project of opening a navigable communication by that route with the Ottawa. It was represented that the approach to the river was so barred by reefs and rendered so intricate by the maze of islands multiplying its outlet into innumerable deltas, that only the most skilful Indian pilots could thread its labyrinth of channels so as to steer their bark canoes into the main trunk of the river.

I have already in this report had occasion to refer to Admiral Bayfield's charts of our Lakes, the accuracy of which is proverbial among those who "occupy their business" in those "great waters." Singularly, however, an error or oversight in nomenclature on that portion of his chart of Lake Huron which shows the outlet of the French River, goes to strengthen. if indeed it did not originate the opinion referred to as common among the casual visitors to that coast, viz., that the river is not accessible for any craft bigger than a birch bark canoe.

I would direct your attention to sheet No. 3 of Bayfield's chart of Huron, and and with it before you, to a group of islands in its north-easterly angle known as the "Bustard Islands."

Looking northward from this point of observation you will see the "Mouths of the French River," noted in conspicuous capitals, debouching amid a number of little islands. Turning due east you will observe an inlet named the "Key," also figuring in capitals; while between it and the first named point is another indentation of the coast; setting up from which, but noticed only in unpretending italics, is a "large river."

The Indians of Lake Nippisingue in going to and fro between their homes and Shibewhenaning or the Sault de Ste. Marie, commonly enter or descend the French River by the "Mouth," so designated by Bayfield, that route affording the best shelter for their canoes; in going to or returning from Penetanguishene they as commonly choose the passage by the "Key," the waters of which, although they do not belong to the French River, approach so near to it at some distance up as to render it accessible for canoes by an easy "portage."

In pursuing my examination of the coast I placed myself entirely in the hands of my pilot, a sagacious Algonquin of Lake Nippisingue, perfectly familiar with every rocky island and inlet of the myriads that stud and indent the inhospitable coasts of the Georgian Bay, merely giving him to understand that my desire was to enter the river by its widest and deepest outlet.

Passing the "Key," which he indicated as the shortest route to Nippisingue, my guide bent his course for the Bustard Islands, and from thence steered directly for the "large river" already referred to, the way into which from the islands being perfectly clear and unembarrassed. It thus for the first time became known to me that the French River had at least one outlet independent of those assigned to it by the chart, and that the large river which most probably was considered by Bayfield as a distant stream, is in reality that arm of the former by which, if ever it is to be adapted to the purpose of modern commerce, vessels will have to enter it. As for the other mouths I have ascertained that they were rightly pronounced to be inaccessible save, as before observed, by the Indian in his canoe.

On reaching the mouth of the river I landed, and looking back upon the bay over which I had just passed, it certainly did seem to fulfil all the external conditions of a noble harbor.

The Bustard Group completely protects it on the south and south-west, while

a heavy sea grinding angrily against a projecting headland of granite on the north-west seemed to announce some shelter against the violent gales which so frequently assail the Lake from that quarter. The bay within was perfectly smooth and unruffled, while without the water was still heaving and swelling from the effects of a night of storm.

The entrance to the harbor is studded across from the Bustards towards the main shore on the north by a few rocky islets, great broad channels between which give every indication of very deep soundings. Close under the Bustard Islands the chart marks sixty feet of depth, in the mouth of the river I paid out twenty feet of line without touching bottom. The intermediate bay, doubtless, has some of those treacherous sunken rocks which beset the whole of that coast, but the general depth of water is great, and deep channels of ample width exist throughout the whole bay into the entrance of the river. The reefs and sunken rocks referred to are almost sure to be of the pinnacle form which characterises the rocks and islands above water, and as they stand up like pyramids with deep soundings all around them are therefore susceptible of being removed without extraordinary difficulty or cost, involving a description of work in fact, which, as it would be permanent in its results, would prove of less ultimate cost than the endless dredging of some of the ever silting harbors of Lakes Erie and Ontario.

A vessel of whatever class, steamer or sailing craft, once within the Georgian Bay, could in any weather at least as easily make the Bustard Islands as any of the more southerly ports, Owen Sound, Collingwood or Nottawasaga, while in the sweeping gales from the north-west, the scourge of Lake Huron, the run from Cape Hurd to the Bustards, having the shelter of the great Manitoulin Island, would assuredly be far safer than that to any of the three lower harbours named. Under the lee of the Bustard group vessels could anchor or moor in the most complete security, blow the wind from what quarter it might, and to drop thence into the river, the depth and directness of the channel being assumed as sufficient, would be practicable under almost any condition of weather short of actual storm.

I consider the harbor formed by the Bay of the French River, described above, as capable of being rendered in every respect suitable for the entrance of a great ship canal. The ordinary adjuncts of lighthouses and piers would, of course, be called for, and a careful survey required to determine the proper site for such erections. It was my intention to have made such a survey in the summer of 1857, had I been permitted to proceed with the work embraced in my first instructions.

THE FRENCH RIVER.

For more than a mile from its mouth upwards the river is broad, deep, and still; in width from three hundred to four hundred feet; in depth probably twenty feet. The banks are of bold granite, that on the north side presenting the appearance of a monster artificial breakwater or pier, rising perpendicularly many feet above the water, and jutting out far into the lake, affording to the entrance complete protection from the blustering winds of the north.

At the end of a mile and a-half or more from the entry, and on rounding a sudden bend, we come upon the first or more properly speaking the last falls of the river, having a descent of about six feet, and in form resembling an artificial weir; the width of the fall being scarce one hundred feet, and the drop from the higher to the lower level almost perpendicular. On the north side the granite rises up boldly from out the water, while on the south there lies a flat table of the same character of rock, its surface but little elevated above that of the water in the upper reach, and the "portage" over which from deep water below to deep water above the cascade is not four hundred feet in length. This table rock is admirably

adapted for the reception of a lock. Such a structure, of the largest required proportions, would almost occupy its whole area, for in width it can scarce boast of one hundred feet when it is overshadowed by a beetling cliff of the same imperishable formation as that upon the opposite side.

A dam across the head of this fall, carried up to a height sufficient to maintain the water permanently at a level of about one foot above ordinary high water mark, or about three feet above the stage at which I found it on the 16th October, 1856, would have the effect of creating a dead level from here to the next falls, some sixteen miles further on, and would completely drown one or two trifling intermediate rapids, without drowning any land. This elevation of the water would give us a lock of nine feet lift to construct, which, with the dam about 100 feet long by 15 feet high, embrace all the work required to render the first eighteen miles of the French River navigable for vessels drawing from ten to twelve feet of water.

I have been thus particular in describing the first fall encountered in the ascent of the river, and which is known by the name of "Les Petites Dalles," because the general features of all the other falls to be surmounted are precisely similar. They are all more or less weir-like in their formation; and this mode of dealing with them, when "improvements" come to be considered, will in every instance be identical; locks and dams being almost the only description of work required to render the river navigable throughout its entire length for any draught of vessels that the harbors of Lake Michigan can send out.

From the "Dalles" to the next falls above, "Le Grand Recollets," the distance, as has been said, is about sixteen miles; the height of the Recollet Fall is seven feet; and then a stretch of eighteen miles more of deep wide water, interrupted by but one short rapid, till we reach the foot of "Rapide de Parisien," the first of a series of four falls extending over a distance of as many miles and separated from one another by deep still ponds. Three locks and dams will completely surmount these obstructions, which have an aggregate height of about eighteen and a-half feet.

At the head of "Rapide des Pins," the uppermost of the four falls just referred to, we find ourselves once again in one of those lake-like expanses of deep water which constitute a principal characteristic of this river, and over the smooth surface of which, in this instance, we skim for eight or nine miles without interruption, till our progress is arrested by the "Chaudière Falls," one of the outlets from Lake Nippisingue. Here the ascent is nearly twenty-six feet to gain the level of that lake.

The "Chaudière" has a course of about a mile in length through a narrow channel enclosed between lofty and perpendicular walls of granite, resembling a combination of mighty locks, from which the pent-up water had swept out the gates. To the southward of this channel a deep still bay sets up towards Nippisingue, approaching to within a quarter of a mile of it. At the head of this bay the "portage" is made, and at that point the facilities for connecting the waters are all that could be desired. Two locks and a few hundred feet of canal would effect a navigable link between twelve feet water above and twelve feet water below the Chaudière portage.

From the entrance of the French River, on the Georgian Bay, to its outlet from Lake Nippisingue, the distance is as near as may be ..... 50 miles.
The ascent about ..... 60 feet.
Making the level of Nippisingue above the sea ..... 632 "

I estimate that the construction of seven locks and eight dams, with not to exceed three quarters of a mile in length of rock cutting, exclusive of that required for the locks, embraces all the work necessary to admit of the transit from Lake Huron to Lake Nippisingue of vessels of one thousand tons burthen.

It has already been said that the mouths of the river are numerous and intricate. The river itself, though sometimes merging into one vast lake, is throughout the greater part of its length divided into two main channels. At the head the waters of Nippisingue pass out through three distinct outlets, all similar in character to the Chaudière. The channel I have endeavored to describe is the southerly one; the Chaudière rapid the furthest south of the triple outlet from the lake.

The French River might more properly be described as a succession of lakes than as a continuous river. The ascent is made in a series of level terraces; the rapids or falls between which are short; assuming, in nearly every instance, the cascade form. The depth of water between rapids is generally very great. I took soundings throughout with my own hand and rarely lighted upon any spot where less than twelve feet of water was to be had, three times that depth being probably more common. The lake portions are studded with islands, clothed to the water's edge with the cedar and the fir, and of every conceivable outline of beauty: while here and there vast bays indent the shores to such a depth that fleets of large vessels might be moored within them unseen among the islands. The river portion are for the most part narrow defiles from two hundred to four hundred feet in width, walled in by towering cliffs of the unchanging granite or its kindred rocks, the syenite and the gneiss, close up to which I invariably found great depth of water. Emerging from these defiles, the lake scenery will again break upon the view, the islands appearing to be more numerous, the bays more varied, as we ascend towards the sources of the river.

The scenery of the Thousand Isles of the St. Lawrence is tame and uninteresting as compared with the endless variety of island and bay, granite cliff and deep sombre defile, which mark the character of the beautiful, solitary French River.

LAKE NIPPISINGUE

Lies just above the 46th parallel of latitude and across the 80th of longitude. In form it is very irregular, but has an extreme length, east and west, of about thirty miles, and a maximum breadth, north and south, of about twenty miles. Its area may be set down in round numbers at three hundred square miles. Its elevation above the sea is 632 feet.

The northerly shores of the lake are somewhat low, generally of flat granite rock; the water shoal upon a sandy bottom. On the southerly side, across which our line of navigation lies, the primitive rocks stand boldly out of the water, which is deep, as much as thirty fathoms sometimes, and commonly three fathoms close up to the shores. For about ten miles from the head of the Chaudière Falls, the character of the lake is in close affinity to that of the French River, the way lying through myriads of islands. We then emerge upon the broad, open lake, across which is a clear, direct, unembarrassed course, of what sometimes proves stormy navigation, to the mouth of the little

"RIVIERE DE VASE,"

in itself an insignificant stream, but of easy adaptation to the purpose of an artificial navigation. Its course lies through wide marshes of deep mud, maintaining a tangled growth of dwarf alder and willow, or between sloping hills of arid sand wooded with red pine. Canoes ascend the vase "portaging" three times for five miles from its mouth till we reach

THE SUMMIT RIDGE,

when we attain a height above Lake Nippisingue of 35 feet; above the sea 667 feet. Here the water-shed of the St. Lawrence and the Ottawa divide, and a portage of three quarters of a mile across the "height of land" brings us to the head waters of

which are enclosed in a beautiful basin of immense depth—"Trout Lake"—in the bays of which, at one hundred feet from shore, we are in eleven feet of water; at two hundred feet, in twenty feet; and then rapidly drop off into sixty, one hundred, and two hundred feet soundings. The length of this lake is eight and a half miles, and immediately below and separated from it by a rocky bar of four hundred feet in length, is a similar basin—"Turtle Lake"—having a length of four and a quarter miles. This gives us some twelve and three quarter miles of smooth, deep water (Turtle being but one foot lower than Trout Lake) to start with on our summit navigation; for, with the exception of the bar above referred to and some few others, detached shoals extending in all over a distance of about fifteen hundred feet and chiefly composed of needle rocks, the points of which (having seldom less than eight feet of water over them) can easily be blasted off, the depth throughout is ample, rarely less than three and generally over six fathoms. The average width of these two basins may be taken at one mile, and their joint area at twelve square miles.

The height of Trout Lake	above	Nippisingue is.....	23 feet.
" "	above	Huron.....	83 "
" "	above	the sea.....655	"

This is the summit water of our route.

I shall take up the question of supply further on, but while we are on the summit, the practicability of connecting the waters—between which, though so near to one another, nature has interposed a barrier—may properly be discussed.

For a canal between Lake Nippisingue and Trout Lake two routes present themselves: The one is by the Vase as already described; and assuming the supply of water on the summit to be sufficient, I would propose to flood the first two miles from the mouth of the river, by raising Nippisingue permanently to a height of about five feet above its highest natural level—a work very easy to be accomplished, and at little cost. This would reduce the extent of actual canalling necessary between the lakes to about three miles, of which about three-fourths of a mile would have a maximum depth of cutting of not more than twenty-four feet, with an average of less than twenty feet; the remaining distance, two and a quarter miles, would average perhaps ten feet in depth of excavation. The material to be worked upon would be chiefly sand and boulders, though, probably, the hard primitive rock would be struck in reaching bottom in the summit cutting. Two locks would be required to overcome the ascent of sixteen feet from the raised surface of Nippisingue (I propose raising it seven feet above low water) to the level of Trout Lake. Seven feet would then be added to the lockage at the Chaudière from the French to Lake Nippisingue.

The other route referred to is by following another small stream, the "Ojibwaysippi," which comes in a mile or so north of the Vase, and along the course of which there exists a chain of lagoons extending to within a short distance of Trout Lake,—no summit intervening between them and it; and so nearly does the level of these lagoons correspond with that of the summit waters that it is not improbable that though now solely tributary to the Ottawa, they at one time found their way to the Nippisingue by this channel.

A canal by the Ojibwaysippi route would be more direct than one by the Vase, and would have an entry on Trout Lake in a far finer bay than that where the latter would terminate. The survey of the former was not completed,—I cannot therefore speak with confidence as to whether on the whole it should be preferred to the better known one by the Vase, but certain it is that by either route the construction of a canal would be an undertaking of marked simplicity, and perfectly feasible within moderate limits of cost.

Before commencing the descent from the summit eastwards, I will recapitulate the work required to complete the navigation to that point, ascending from the west:

	Natural Navigation.	Canal Navigation.	Total Distance.	Height to be overcome.	No. of Locks.	No. of Dams.
	Miles.	Miles.	Miles.	Feet.		
French River.....	49	1	50	67	8	8
Lake Nippisingue.....	30	..	30	..	..	3
Summit Barrier.....	..	5	5	16	2	..
	79	6	85	83	10	11

The dams in the French River would be structures of inconsiderable magnitude, averaging not more than 100 feet in length by twelve feet in height. Those on Lake Nippisingue would not exceed twice those dimensions when largest.

The greatest depth of cutting at any point in the canal portions of the route wou d be under thirty feet.

I now return to the Matawan, the upper reservoir of which, formed by Trout and Turtle Lakes, has already been described.

The outlet from Turtle Lake is through a rocky river, generally shallow and rapid, though having occasional ponds of deep and level water. The length of this neck is a little over four miles, when it delivers the water into another vast basin—Lac Talon. The fall between Turtle and Talon basins is about thirty-two feet. Three locks can be conveniently constructed, and damming resorted to with good effect to obtain the requisite depth of water, without recourse being had to heavy excavations.

Lac Talon is in length ..... 7 miles.
Its height above the sea is..... 622 feet.

Its general depth is very great, from ten to twenty fathom soundings prevailing over a large portion of it. Two bars exist near its lower extremity, having from five to eight feet of water over them. Their combined length is about thirteen hundred feet, and they stand, in both cases, on the verge of very deep water.

Lac Talon discharges its water precipitously in a splendid *chute* of forty-three feet fall, very narrow, and bound in by granite cliffs of great height. From deep water above to deep water below the *chute*, there is about twelve hundred feet of length, and in a deep ravine upon the southerly side nature has plainly pointed out the site for future locks.

Below the Talon *chute* there is a series of four basins or ponds, and three rapids; the former occupying a combined length of two miles, the latter three quarters of a mile. The descent is twenty-one feet, requiring two locks and dams to perfect the navigation. The uppermost and longest of the "ponds," a mile and a fifth in length, is very wide, and from twenty to one hundred and twenty feet in depth; the others are no where less than one hundred feet in width, and have a least depth in mid-channel of eight feet.

We next come to the "Portage des Paresseux," where the water tumbles over in a fine cascade, thirty-four feet in height, the whole length of the interruption being about a quarter of a mile. Here a thorough cutting through hard

rock will have to be resorted to in effecting a navigable passage from the head of the rapid to the foot of the cascade; three locks will also be required. The extreme depth of cutting will not exceed twelve feet.

Immediately below the Paresseux *chute* we are in very deep water, and between bold and beetling cliffs of the all-pervading syenite; in a great fissure in the rock, in fact which closes in at one point till scarce eighty feet of width is left between sides. The least depth of water in this narrow defile is forty-three feet. You may suspend a plumb line upon the face of the rock on either side of the river, and keep paying it out for that number of feet ere the lead rests upon the bottom.

The whole still water distance from the Portage des Paresseux till we arrive at the next rapid below is somewhat more than three miles, and over that length, save at one point, the depth of water is very great, and the width ample for all purposes of ship or steam navigation. The "narrows" already referred to as having some eighty feet of width, are very narrow as compared with the general width of this reach of the river. The one point alluded to as shallow is where the stream is divided into two by "Les Aiguilles" Islands, the channels around which are impracticable for the passage of any craft bigger than a five fathom canoe; nature has however placed close at hand the means of remedying this obstruction. The shoal is not more than two hundred feet in length, when it at once drops off above and below into upwards of nine fathom soundings.

From the foot of "Lac des Aiguilles" we have an alternation of rapids and ponds for a little over two miles, the whole fall in that distance to the foot of "Portage des Epines," being about eighteen feet. The locks and dams will surmount all the obstructions encountered on this section of the Matawan.

At the foot of "Les Epines" Rapids we enter "Lac Plein Chant," a magnificent stretch of deep water. In length it is nearly five and a half miles, in width very variable, from two hundred up to two thousand feet. Its general breadth may be taken as between four hundred and five hundred feet. Where deepest forty-five fathoms of line failed to touch the bottom. The general depth ranged over five fathoms; the only shoal spots that have been found to exist being of inconsiderable extent, and having from twelve to twenty feet of water upon them.

The end of Lac Plein Chant brings us to within about two and a half miles of the confluence of the Matawan with the Ottawa. That distance is broken by three rapids, having an aggregate fall of nearly twenty-one feet. One half of that length has deep and level water; the remainder may be put down as requiring to be canalled. Three locks will be necessary.

Having now reached the Ottawa, I will, before proceeding down that river, condense the features of the Matawan into tabular form, so as to show at a glance what is the extent of artificial work required to render its length of forty miles or more continuously navigable on a scale proportioned to the capacity of the waters westward of the summit.

TABLE OF MATAWAN RAPIDS.

SECTION OF RIVER.	Natural Navigation.	Canal Navigation.	Total Distance.	Falls to be Locked.	No. of Locks.	No. of Dams.
	Miles.	Miles.	Miles.	Feet.		
Trout and Turtle Lakes	12.70	0.05	12.75	....	..	..
Turtle Rapids	....	4.20	4.20	32.75	3	3
Lac Talon	7.00	....	7.00	....	..	..
Talon Chute	....	0.22	0.22	42.75	4	1
Eel Lake	1.20	....	1.20	....	..	..
Series of Rapids and Ponds	....	1.48	1.48	21.15	2	2
Chute des Paresseux	....	0.23	0.23	34.12	3	1
Lac des Aiguilles	3.15	....	3.15	....	..	..
Rapids des Aiguilles, La Rose, Les Epines	....	2.14	2.14	18.54	3	3
Lac Plein Chants	5.40	....	5.40	....	..	..
Plein Chants and other Rapids to Mouth	1.21	1.44	2.65	20.69	3	3
	30.66	9.76	40.42	170.00	18	13

As in the French River, the dams will be simple structure, not to exceed, when largest, two hundred feet in length by twelve in height. Of the canal portion, one third will be formed by raising the level of the water; the other two thirds, embracing the sites of the locks, will be excavated wholly in rock, but at no point is it likely that the depth of cutting will exceed twenty feet.

Combining the above table with that on page 18, it will be seen that from the entrance of the French River to the mouth of the Matawan

The total distance is ..... $125\frac{42}{100}$ miles.
" ascent and descent ..... 253 feet.
" extent to be canalled ..... $9\frac{3}{4}$ miles.
" number of locks required 28
" number of dams 24

I have now to deal with the Ottawa itself, which at the mouth of the Matawan, more than three hundred miles above its union with the St. Lawrence, is still a noble river, about fifteen hundred feet in width and very deep.

Trout Lake, our summit water, has an elevation above the sea
(*vide* page) of ..... 655 feet.
The total fall of the Matawan is ..... 170 "
Leaving for the elevation of the Ottawa at this point ..... 485 "

Immediately below where the Matawan comes in there is a rapid of some five feet fall, where a lock and side cut of about a mile in length will be required. I sounded below the rapid and found twenty-four feet.

For seventeen miles from the "Matawan Rapids" the Ottawa continues very wide, direct and deep, and, though with a decided current, is a splendid piece of natural navigation the whole way. The banks are for the most part bold, precipitous and rocky; the scenery very grand.

At nineteen miles below the Matawan we are at the head of a series of three great rapids, occupying a distance of three miles; La Vallée, Le Tron, and Les Deux Rivières. The pitch is thirty-two feet; the opportunities for locking and canalling highly favorable.

From the foot of Les Deux Rivières we have ten miles of broad deep water, which brings us to the head of the "Rocher-Capitaine," the grandest of the mag-

nificent rapids of the Ottawa. The fall here is forty-five feet. On the north side of the river is a flat table-land, but little elevated above the level of the water at the head of the rapid, and well adapted in form to the construction of a canal, the length of which would have to be about two miles, with, at the foot, a flight of four locks in combination. The excavations required here would, as far as external indications justify one in determining, be chiefly through masses of large boulders.

Leaving the "Rocher-Capitaine," we are once again on the broad bosom of the Ottawa, and have sixteen miles of open navigation, uninterrupted save by some strong currents, to "Les Rapides des Deux Joachims," where in two miles there is a fall of twenty-eight feet. A careful survey would be required here to determine the proper site for the canal, which must be on the north or Lower Canada side of the river. Two routes present themselves as practicable; the longer one, passing through a ravine of some three miles in length and entering above near "Ferres' Clearing," I have not thoroughly examined. The other would enter near Cotton's farm, not far above the head of the rapid, and would involve some heavy rock cuttings, inconsiderable in length however, through ridges crossing at right angles to the line of canal. The facilities for fitting in locks near the lower end, and for forming most convenient entrances at both termini, are very good indeed.

The descent at "Les deux Joachims" brings us into the "Deep River," a stretch of twenty-eight miles of apparently motionless water, very wide, and of great depth. I have no soundings of this section of the navigation, nor indeed, except to gratify curiosity, would there have been any occasion for testing the depth. On the south of this superb piece of water, the general conformation of the country is that of an elevated and comparatively level plateau; the prevailing character of the soil being dry and sandy, the forest nearly altogether of red pine and white birch. On the north side, very bold mountainous scenery prevails: all that can be seen of the country in that direction, as one passes down the river, being harsh and barren with the syenitic rocks frequently towering up to immense heights over the deep water.

The "Deep River" may be said to terminate a little below the Hudson Bay Company's post, Fort William, when a group of islands multiplies the channels, and for less than a quarter of a mile renders the navigation intricate. The soundings of this part have not been completed, but I entertain little doubt of the existence of a deep channel, though there is much shoal water, over boulder *battures*, between the islands; clearing which we have five miles more of deep water, to the head of the "Culbute" Fall, on the north side of the Allumettes Island.

As stated in the outset of this report, the Ottawa, lying between the mouth of the Matawan and the Fort of the Deep River, was not submitted to actual survey. The description above given is therefore the result of such general examinations as an exploratory "voyage" would admit of. For the fall of the river at the various rapids above "Les Deux Joachims" I am partly indebted to the maps of Sir William Logan; the descent due to the current between rapids I estimate from the time occupied in the canoe journey between each, the whole being checked by the ascertained elevations at the mouth of the Matawan, and at the foot of the Deep River, which are as follows:

Mouth of Matawan above the sea	485 feet.
Foot of Deep River	351 "

The entire series of rapids over the whole route, their respective descents, and their relative distances apart, are exhibited in Appendix A.

It has been mentioned on page 2 of this report, that by far the most obstructed portion of the Ottawa is that extending from Fort William, at the foot of the Deep River, to Portage du Fort, at the head of the Chats Lake, a distance of sixty miles.

To this section of the route surveying operations were mainly confined, and the results fully confirm the conclusion I had from personal observations previously arrived at, namely, that on the north side of the river throughout the whole of this distance are presented the best facilities for improving the navigation.

The most striking feature of this part of the Ottawa is its severance for the greater portion of the way into, as it were, two distinct rivers. The "Allumettes" Island, commencing six miles below Fort William, has a length of six miles, with an average width of perhaps four miles. To the south of this large island passes the main river by the Pembroke Channel and the Allumettes Lake, presenting long stretches of rapids and much shallow water; the fall of the river in the length of the island being about nineteen feet.

The northerly channel, much narrower than the other, though seldom less than one-fifth of a mile in width, concentrated nearly the whole fall into two cascades at the head of the island, the "Culbute" and "L'Islet" Rapids, the length of broken water at which is less than two miles, the descent not quite eighteen feet. The remainder of the distance, save for a short rapid with fifteen inches fall at the "Chapeau," is smooth water, deep throughout, except for some two and a quarter miles made up of detached shoals of gravel or silt, on which the soundings vary from seven to eight feet. By deep water, I mean twelve feet and over; the general depth in mid channel is from fifteen to twenty-five feet, soundings of forty, fifty, and seventy feet even being not unfrequent.

At the foot of the Allumettes Island, the two arms of the river by which it is encircled, come together, forming "Lac Coulonge," across which we have eleven miles of wide water. The northerly side of the lake, in continuation of the Culbute Channel, has been carefully sounded, and nine miles of the distance ascertained to have ample depth. The other two miles, consisting of five shoals isolated from one another, and varying in width between one-half and one-fifth of a mile, have from eight to nine feet soundings over bars of silt except at one point where a sharp and narrow ledge of rock is found to protrude to within nine feet of the surface. The fall of the lake on the line of soundings is one foot nine inches.

Lac Coulonge terminates at the head of the "Calumet" Island, when, as at the Allumettes, the main river seeks the southerly side, passing down in a long and wild rapid through the "Rocher-Fendue" Channel. The ascent of the river from Lake Coulonge to smooth water below Portage du Fort, twenty-seven miles, is about one hundred and two feet.

On the northerly side of the island, we have still water from the head to the Grand Calumet Falls, for seventeen miles; the descent in that distance being but four feet. This part of the river, known as the "Calumet Channel," resembles a great natural canal, the width of which may be taken at an average of 600 feet. The depth for one-half the distance varies from eleven to twenty feet; for the other half, from six to nine feet; the shoal portions being in banks here and there alternating with pools of deep water. A dam at the head of the Grand Calumet Falls, to raise the water four or five feet above low water level, the datum to which the soundings refer, would at once reduce the extent of shallow soundings from upwards of eight to about four miles in length, and, as the banks appear to consist wholly of deposits of silt, the dredge would soon effect the required depth through the obstructed portions of the channel not remedied by the raising of the water.

The main fall of the river, from Lac Coulonge to the Chats Lake, which in the southerly or Rocher-Fendue Channel is extended over a great length, takes place in the northerly or Calumet Channel, within a distance of ten miles, commencing at the Grand Calumet Falls, seventeen miles below the head of the island, and ending at Portage du Fort. The entire descent in this distance is ninety-eight feet, separated into six distinct falls, between which are level reaches, where the water can be conveniently dammed up so as to obtain the requisite depth for navigation.

The following is an abstract of the features of the northerly side of the Ottawa from the head of the Allumettes to the foot of the Calumet Island :

Level of water at head of Culbute Rapid, referring to the sea.. 350 feet.
" " Chats Lake at Portage du Fort ..... 227 "

Whole descent from head of Culbute to Portage du Fort.. 123 "

The distribution of which is as follows :—

	Fall.	Distance
	Feet.	Miles.
Culbute and L'Islet Falls, six miles below Fort William.....	18	..
Length to be cancelled at those Rapids.....	..	2
Fall of River, foot of L'Islet to Grand Calumet Falls.....	7	..
Distance do do	..	42
Grand Calumet Fall	56	..
Dargis, Mountain, Sable and other Rapids.....	42	..
Grand Calumet to Portage du Fort—smooth water	..	5
do do rapid water	..	5
Total fall.....	123	..
Total distance.....	..	54

At the Grand Calumet the fall is flanked at some little distance in on the south side by a deep ravine, which sits in from smooth water a short way above the head of the rapid, and terminates when the water, after a descent of fifty-six feet, has regained its depth and tranquillity below. Through this ravine a canal two miles in length can be led with a facility of which first impressions of the rock-bound and precipitous torrent give no promise.

The rapids below the main *chute* at the Calumet, five in number, will require as many locks, situated relatively to one another at average distances of more than a mile apart. In the reaches between them the requisite depth for navigation, where not already existing, can mainly be obtained by throwing dams across above the locks, and the construction of which will be much facilitated by the existence of numberless islands of bold and rocky outline. The amount of excavation to be encountered in improving this section of the river will not be very great.

The last of the above series of rapids brings us to the village of Portage du Fort, situated on a deep bay at the head of Lac des Chats, a stretch of eighteen miles of navigable water, terminating at the Chats rapids, where a canal connecting with the next lake below has already been commenced.

Careful soundings have been taken from Portage du Fort to within a couple of miles of the head of this canal, and but two obstructions to deep water navigation found to exist. The first is a bar composed of sand and rock half a mile below the portage. In length it is about twelve hundred feet, the depth of water upon it from six to ten feet, deepening immediately on either side to seven and eight fathoms. To cut a channel of sufficient depth through this bar would be a work of no great labor or cost.

The other obstruction alluded to is " Les Cheneaux " rapid three miles below, when a sudden pitch of eight inches causes the main body of the water to rush

with great force through a deep and narrow channel, the main breadth of the river being marked by a reef of rocks over which the water is broken and shallow, at low water the one steamer which plies upon this lake has much difficulty in breasting this short rapid so as to ascend to Portage du Fort.

The Cheneaux rapid can be completely obliterated by throwing a dam or a series of dams across the head of the Chats Rapids, at the foot of the lake, where a multitude of rocky islands, scattered across the river, render such an undertaking already half accomplished by nature.

The remainder of the Chats Lake, save the two miles next above the canal, not sounded because of the failure of the ice, has, as above observed, been ascertained to be deep, often upwards of eighty and rarely under twenty-five feet, except at one or two points when it should be two and a-half fathoms; and there is every reason for supposing that the deep water character continues close up to the entrance of the canal.

The low water level of the Chats Lake referring to the sea, is 127 feet.
The fall of the Chats rapids at the foot of the lake is..... 50 "
The length of the Chats Canal..... 3 miles.

We then enter Lac des Chênes, encountering a good deal of shoal water for the first half or three quarters of a mile after clearing the Chats Canal, and have then twenty-seven miles of wide direct navigation, deep throughout except for occasional short bars with twelve feet water upon them, to the head of the "Chaudière" rapids, around which four miles of canal and two miles of river navigation, with a descent of sixty-seven feet, brings us into that magnificent basin on which stands the City of Ottawa, formerly called Bytown.

From the mouth of the Matawan River to Ottawa City is.....195 miles.
The descent of the water in that distance is.....376 feet.
Distributed as follows:

NAME OF RAPIDS, &c.	DISTANCES.		Fall of River.	Elevation above the Sea.
	River and Lake Navigation.	Canal Navigation.		
	Miles.	Miles.	Feet.	Feet.
Matawan Rapids	1	1	5	485
Matawan to La Veillée Rapid	17	0	9	
La Veillée, Tron, and Deux Rivières	0	3	32	
Deux Rivières to Rocher-Capitaine	10	0	5	
Rocher-Capitaine and Grand Maribout Rapid	0	2	45	
Rocher Capitaine to Deux Joachims	16	0	8	
Deux Joachims Rapids	0	2	28	
Deep River to head of Culbute	34	0	3	350
Culbute to L'Islet Rapids	0	2	18	
L'Islet to Grand Calumet Falls	42	0	7	
Grand Calumet and other Rapids	5	5	98	
Lac des Chats	18	0	1	227
Chats Rapids	0	3	50	
Lac des Chênes	28	0	0	176
Chaudière Rapids	2	4	67	
Ottawa River at the City of Ottawa	0	0	0	109
Total	173	22	376	

At Ottawa, my examination of the chain of waters under consideration terminated, it having been my intention to have made the portion of the route thence to Montreal the subject of enquiry during the present year, had the survey not been suspended. The general features of that section, commonly termed the "Lower Ottawa" may be stated as follows:

Ottawa to Grenville—still water navigation	54 miles.	
Grenville to Carillon, do do	4 miles.	
Do do Canal, do	8 "	
	—	12 "
Lake of the Two Mountains, Carillon to St. Anne		20 "
St. Ann Rapids		½ "
Lake St. Louis—St. Ann to Lachine		15 "
Lachine Canal—Lachine to Montreal		8½ "
Total distance, Ottawa to Montreal		110 miles.

And the Lockage is—

Grenville to Carillon, Long Sault, Chute au Blondeau, and Carillon Rapids	48 feet.
St. Anne Rapid	3 "
Sault St. Louis, Lachine Canal	45 "
Total Lockage	96 feet.

The Lower Ottawa has long been in use as a channel of steam navigation; the rapids between Grenville and Carillon having been canalled for vessels of five and a half feet draft (at low water), and measuring 108 × 19 feet, as far back as thirty years ago, by the Imperial Government, and until within the last twelve years the interchange of commerce between Montreal and Upper Canada was mainly carried on through the instrumentality of those works. During the season of navigation propeller steamers of the above dimensions were constantly ascending the Ottawa as far as Bytown, where they entered the Rideau Canal, and found their way by that route through the heart of the country, to the foot of Lake Ontario at Kingston. The downward trips of these vessels were made by way of the St. Lawrence,—their light draft of water enabling them to run all the rapids with ease and safety, and thus to accomplish the journey with despatch.

The completion of the St. Lawrence canals, in 1846, threw the Ottawa and Rideau route into disuse, save for the local trade of the circumjacent districts, to the convenience and development of which those pioneer canals of Canada continue largely to contribute.

From the information I have been able to gather concerning the depths of the Lower Ottawa, I incline to the belief that in it will be found to exist the most serious of the difficulties to be encountered in carrying out the project which is the subject of this Report, and those difficulties I apprehend increase as we descend. In the fifty-eight miles of still-water navigation between Ottawa and Grenville, the shallows are likely to be occasioned by bars of silt and alluvial deposit, the removal of which would not be attended with any great amount of labor or expense, nor would the enlargement of the Ordnance Canals between Grenville and Carillon be an undertaking of extraordinary difficulty, but it is to be feared that there does not exist through the Lake of the Two Mountains, a channel sufficiently direct and deep to promise the attainment there of a navigation of equal capacity to that which nature has provided for in the Upper Ottawa, the Matawan, and the French River. The shallows of the Lake of the Two Mountains are undoubtedly over rock bottom, and in the course which the steamers plying between Carillon and St. Ann commonly steer, there are many shallows. The non-existence of a deep channel is, however, by no means to be set down as certain on that account. The obstructions above and below the lock at St. Ann have hitherto limited the draft of vessels to six feet, and those persons engaged in the trade of the river have been satisfied to find water enough for their purpose in their accustomed path, without going out of their way to ascertain facts that in no degree affected

their interests. In estimating the extent of canalling required on the proposed line of navigation, I provide for three miles at St. Ann, where there is now but a single lock, with a few hundred feet of wing-dam at either end of it.

Above the rapids of St. Ann the river divides around the Island of Montreal into two branches. The main volume passes down the north side through what is called "La Rivière des Prairies," and over the Sault-au-Recollet Rapid till it finally merges in the St. Lawrence, at the foot of the Island.

On the south side, at a few miles below St. Ann, we enter Lake St. Louis, where the Ottawa meets, though it will not mingle with the St. Lawrence. On a clear summer day, when the surface of the Lake is calm, the line of demarcation between the dark waters of the north and the pale waters of the Great Lakes, nearly equally dividing its area between them, is unmistakeably defined.

Through Lake St. Louis to Lachine, and the shallows below St. Ann are passed, a channel for vessels of ten feet draft either exists already or is easily attainable.

The Lachine Canal, taking us past the Sault St. Louis to Montreal, is so well known to all concerned in the trade of the St. Lawrence and the Ottawa that it is hardly necessary to allude to it; but as the last artificial link connecting the Lower St. Lawrence and the ocean with the great chain of the interior waters of Canada, which will yet form so important a step in the way to the west, it may be as well to state that

The length of the Canal is ..... 8½ miles.
The lockage ..... 45 feet.

And that its eastern terminus is in the Harbor of Montreal. The depth of water for which the canal is adapted is nine feet on the mitre sills of the locks, and the locks themselves are two hundred feet in length between the sills with a clear width between quoins of forty-five feet.

Having now reached the termination of our route, I will briefly recapitulate the distances, lockage, &c., which form the substance of the Tables on pages 18, 20, 24, and 25 of this Report.

River and Lake Navigation.....	372	miles.
Canal " (including the Lachine)	58	"
Total distance Lake Huron and Montreal....	430	"
Rise Lake Huron to summit	83	feet.
Lockage.....	83	"
Fall summit to Montreal	642	"
Lockage.....	615	"
Total Lockage	698	feet.

I have now completed my sketch of the various waters which form the several links in the Ottawa and French River navigation; but there still remain for discussion three important questions—supply, capacity, and cost—ere a final opinion can be pronounced on the practicability of so great a project. Each of these I will now proceed to touch upon in their foregoing order, and first as regards the vital one of

SUPPLY.

It may at once be stated that the summit does not furnish water sufficient to meet the demands of even a far inferior scale of navigation to that which the general character of the route would warrant us in looking forward to.

Standing upon the cliffs overhanging the Talon Chute, on the Matawan, one sees at a glance, rushing through the narrow gorge at his feet, the whole of the water which the deep and land-locked basins above it receive from the surrounding

country; and, without resorting to experiment, a practised eye can quickly form a sufficiently correct estimate of the discharge to justify the conclusion that it is inadequate to the purpose in view.

A canal of the size of the Welland, with locks 150 and 27 feet average, lift eleven feet, to pass 50 vessels per day, would draw upon the sources of supply to the extent of 3,000 cubic feet per minute. Increasing the dimensions of the locks to those of the St. Lawrence Canal, 200 × 45 × 10 feet, would double that consumption, making it equal to 6,000 feet per minute.

Even allowing for the large storage afforded by the twelve square miles of surface in the two summit reservoirs, Turtle and Trout Lakes, and further allowing that storage capacity to be doubled by hoisting Talon Lake up to the summit level—which could be easily done—I am satisfied that the sources of the Matawan could not be relied upon for more water than would be sufficient to meet the least of the above demands, while the minimum size of lock I would think of adopting would be that representing the greater consumption.

The season of navigation on the Welland Canal has been found, from several years' experience, to average as near as may be..... 200 days.

The number of vessels locked through in 1856 was 3885

" " 1857 3604

And the greatest number passed in any one month of the latter year was in June, amounting to..... 636

Or nearly 25 vessels for a maximum day's business.

In basing my calculation of the consumption of water to be provided for on the Ottawa route on double the above number of vessels per day, vessels, too, of more than double the capacity of those to which the Welland is adapted, it may seem that I am estimating in excess of any probable increase of the trade of the west. If I am in error, the project of opening up the Ottawa route might be abandoned without further discussion; but the quadrupling of the present commerce of the lake is surely within the limits of certainty, as its arrival at those proportions within a moderate space of time is within the limits of probability; nor is it speaking too hopefully to predict that when that time has arrived, western commerce will still be on the road of progress, advancing with giant strides towards the Pacific.

With such a future in prospect, the supply of water on the summit has been stated to be insufficient, and, unless artificial means can be resorted to, to make up the deficiency, the project of our Ottawa navigation on a large scale is, of course, at an end. Fortunately, however, such means of assistance are at hand and are to be rendered amenable to our purposes in the following manner:

Lake Nippisingue is 23 feet lower than Trout Lake—the summit—I propose by means of dams thrown across its outlets to raise it to the latter level, and thus at once increase the storage capacity of the summit reservoir from twelve to upwards of three hundred square miles.

In speaking of the Chaudière outlet of Lake Nippisingue into the French River (*v.* page), I have said that the passage is through a narrow channel between lofty walls of rock "resembling a combination of mighty locks from which the pent-up waters had swept out the gates." The other two outlets are of similar formation, presenting great facilities for the construction of dams to any required height. In this way the lake can be raised 23 feet above its natural level and an inexhaustible supply obtained to feed both ways from the summit; for even setting aside the enormous storage capacity of its immense area, the accession of water which Lake Nippisingue receives from its many tributaries is ample to guarantee a sufficiency for whatever drafts may be made upon it, for any probable purposes of lockage in the most distant future.

On the north and north-west come in the "Sturgeon" and "Widow Rivers," on the south-east and south the Namantagohns and Wassi-Wissing. Many minor streams, besides, contributing at various points along the coast to swell the measure of its waters.

The objectionable feature in this mode of obtaining the supply necessary to feed the canal is the drowning of the circumjacent lands. This effect would not be produced to any considerable extent on the southerly and easterly borders of the lake, but around the northerly and north-westwardly shores vast tracts of land would be submerged; unfortunately, too, the best lands which are to be found in its immediate vicinity. Admitting, however, the merits of the project as a whole to be such as I have endeavored to show them to be, I apprehend that few will be found to argue that this necessity for the destruction of untenanted land, a mere patch in the unreclaimed wilderness, should be allowed to stand as a veto on its fulfilment.

The raising of Lake Nippisingue would reduce the actual canalling between it and Trout Lake to less than half what would be required were the latter body of water capable of furnishing the necessary supply; and, as the cost of one mile of canal would be more than that of all the dams together, it follows that the cost of the whole work on the plan proposed will be considerably less than if the supply were drawn from the natural summit.

As works of art, the dams would be of inconsiderable magnitude when compared with some of those stupendous structures of that class which are to be seen on the Rideau Canal—enduring monuments of the indomitable perseverance and high engineering skill of the gallant Colonel By.

I now come to the question of the

CAPACITY

Of the route as a continuous line of navigation between the lower St. Lawrence and the western lakes; in other words, with a view to the recommendation of what class of vessels should "improvements" be designed.

It is as a steam navigation, and more especially for that denomination of steamer known as the "propeller," that I believe the Ottawa and French River route is destined to hold a first place as a channel of trade. For vessels of that description the character of the waters, and of the region on either side of them, is peculiarly fitted. Land-locked for the greater proportion of the way, the route will not in that respect be as advantageous for sailing craft as that by the great lakes, but the inexhaustible supplies of wood at all points along it, and the facilities for taking their fuel on board at frequent intervals, will for ever render the cost of working steam vessels lower on this than any equal length of navigation on the continent. Here, too, the propeller can keep "the even tenor of its way," heedless of the storms which, sweeping across the lakes in the autumn of each year, cause such immense destruction of life and property.

Mr. J. B. Jervis, in his report on the projected Caughnawaga Canal, furnishes much valuable information respecting the propeller craft in use upon the lakes, and subscribing as I do, in the main, to the soundness of his conclusions relating to the size of vessel best adapted to the trade of those waters, I cannot, in adopting, better convey his opinions than by quoting his words. He says:

"I have obtained a list of forty-eight propellers with their principal dimensions. Only eleven of these propellers can pass the locks on the Welland Canal: most of them are employed in the navigation of the upper lakes. There are but two of them under 300 tons burden,—the largest 850 tons. The greater portion range from a few tons under 400 to a few above 600. The greatest length is 234 feet—the "Iowa,"—and her actual tonnage is 720,—draws 11½ feet, loaded. The

"Oriental" is 234 feet; actual tonnage 850, (2½ feet more beam); draws loaded 10½ feet of water. The "Plymouth" is 225 feet in length, (loaded draft not astained,) and carries 700 tons. These vessels can only carry full cargoes when the lakes are at their greatest height. There are times, occurring every year, when vessels with over 9½ feet draft of water cannot pass the St. Clair Flats; consequently those of greater depth must load lighter than their capacity, or depend on lightening when they reach the Flats, or have occasion to enter harbors of similar depth of water. The two most important lake ports for outward bound tonnage are Chicago and Toledo. The entrance into the harbor of Chicago is kept open by excavation, so that vessels drawing ten feet of water can, for the greater portion of the season of navigation, enter the harbor. Toledo is on the Miamee River, and 9 feet water is as much as can usually be depended on, though at times they can go in with 10½ feet. Detroit River affords better water, and vessels that can pass the St. Clair Flats easily make Detroit.

"In the enquiries I have been able to make as to the draft of water that vessels could carry and make the harbor with safety on the upper lakes, I have found considerable diversity of opinion among navigators. The range of opinion has been 8½ to 11½ feet. It is admitted by those that advocate 11½ feet that lightening will often be necessary, and this is considered to injuriously affect the profit of and cause delay in the voyage. It is an important fact that the most usual time for high water (not regarding those rises and falls that occur in a series of years) is in midsummer, and lowest in spring and autumn,—the latter are the seasons of greater pressure in freight. It is considered, generally, that the largest vessels can only make full loads when the lakes are most favorable, and then only to the port having the greatest depth of water. So far as I have been able to ascertain, it appears the most prevalent opinion that the largest class of propeller, both in relation to length and draft of water, has not been so successful in economy of transport as those of less dimensions. The greatest weight of opinion I have been able to obtain is that a draft of 9 or 9½ feet is as much as can profitably be adopted for general use, and that 10 feet is the extreme draft that should in any case be adopted, and only for ports of best water. In the opinion of several very experienced navigators, the propellor "Portsmouth," in her main features, is the best pattern for general use and economy of transport; she is 175 feet long, and draws 9½ feet water; cargo 5,000 barrels of flour. Some would add 5 feet, others 15 feet to her length—this last addition would make her 190 feet long, and with a small increase of beam would enable her to carry 6,000 barrels. Objections are made to greater length on account of the increase of weight that is required to give the requisite strength on a vessel of so small depth as must be adopted for lake navigation."

The beam of the largest of the propellers instanced by Mr. Jervis, (the "Oriental,") is 34 feet; that of the medium size, such as the "Portsmouth," 28 feet; and as the result of his enquiries and observations he recommends locks of two hundred feet in length by thirty-six feet in width, with depth of water to admit the passage of vessels of 9½ feet draft, as the most judicious size to be adopted for the Caughnawaga Canal.

When the Commissioners did me the honor to entrust to me the examination of the Ottawa chain of waters, I entered upon the task with the conviction, growing out of previous knowledge of the general capacity as to depths of the harbors of the lakes, that ten feet of water was as much as it was desirable to seek for in ascertaining the capabilities of the route. It was my belief also, then as it is now, that if nine feet depth was found to be obtainable throughout, I might speak with favor of the project, and predict its success. That the harbors of the lake ports are not, as a general thing, adapted for ten feet draft of water, I was well aware, and it must be obvious to any one who has at all studied the subject, that

the vessel which can at any stage of the lakes obtain or deliver her cargo in the greatest number of the principal ports, must be a more profitable one to employ in the trade than the larger craft, which, from her excessive draft, must limit her intercourse to one or two of the deeper harbors, or else, more unprofitable still, make her trips with light loads. I am not of those who believe that sea going vessels will ever be freighted to any considerable extent in lake ports; and in that belief had an additional reason for adopting ten feet as the available maximum depth that there was any occasion for attempting to obtain. That depth (with a reservation as regards the lower Ottawa) I believe to be practicable throughout, and upon it I shall base my estimate of

COST.

The cost of canalling, or improving river navigation, increases in rapid ratio as we seek for increased depth, and from a general estimate I have made, I would not venture to set down the difference in cost between the forming of a *ten* feet and a *twelve* feet navigation through the Ottawa, Matawan, and French River, at a less sum than five millions of dollars, a useless expenditure when the lesser draft is so obviously sufficient. I would recommend, then, that the mitre sills of all locks henceforward to be constructed on the Ottawa and other waters in the chain, be calculated for a least depth of ten feet. Nine and a half, or even nine feet, would doubtless answer all purposes for a long time to come, but whenever the greater draft may become a necessity, let there be no pulling down of solid masonry or ripping up of costly foundations in order to obtain it.

On the question, then, of the draft of vessels best adapted to the commerce of the Upper Lakes, to attract which is the common object of the Ottawa Canals and the Caughnawaga, Mr. Jervis and myself are of one opinion; but as relative to his other dimensions, while freely admitting that he has made out his case as applying specially to the latter, I cannot agree to adopt them as equally suitable to the former project, and for the following reasons:

The Ottawa route possesses certain distinctive features which entitle it to other considerations than those incident to a mere channel for merchandise. Penetrating the heart of our country, it can boast of magnificent scenery, which, as it becomes accessible and known, cannot fail to attract the tourist, as well European as American. The waters consist to a great extent of a succession of noble lakes, between which, as the country becomes inhabited, and civilization turns its resources to account, internal intercourse will spring up creating a trade apart entirely from the dull routine of western traffic, propeller following propeller, with their eternal cargoes of grain and flour. To prohibit by a deliberate act, and for all time to come the use on Ottawa waters of the paddle wheel steamer, with her commodious upper cabin and promenade deck, would be a mistake. I propose, therefore, to fix such dimensions for Ottawa locks as will admit the passage of vessels of that denomination superior in some points to those which, as passenger boats, now use the St. Lawrence Canals.

I have before stated the size of the St. Lawrence locks at 200 feet long by 45 feet wide. The depth of water on the mitre sills is nine feet. They are not justly proportioned, being too short for their width. The largest of the passenger steamers now in use, the "Arabia," for instance, so completely fill the chamber of the lock as to require considerable manœuvering to get them in, and to close the gates behind them when they are in. The process of locking is thus rendered more tedious than it need have been were there a little more "play" for the vessel. It is well known, too, that these vessels are short in proportion to their beam, and that with from 25 to 30 feet more length, they could have all the speed necessary to give them equal rank with the larger lake steamers; while now, though having to compete with those for the lake business, they only rank as river boats. In short, while not sufficiently

large properly to fulfil the purpose for which they are designed, they are too large for the canal locks.

It is not likely that much more than 45 feet beam would ever be required for vessels intended to combine the attributes of lake-craft and river-craft; but assuming that as the extreme width of vessel, the lock should certainly be as much wider, say five feet, between the gate quoins, as would allow of her entering it with ease and dispatch, and without lifting her guards. For the extreme length of vessel to be accommodated, I would assume as my standard the longest propeller now in use upon the upper lakes, the "Iowa." Her length is 242 feet; to which I propose to add eight feet, to make up the length of my lock.

With the above additions, the dimensions I recommend for the Ottawa locks are as follow:

Clear length between the mitre sills..... 250 feet.
Clear width between the gate quoins..... 50 "
Depth of water on the mitre sills..... 10 "

And here I think we have a well proportioned lock to which no exception can be taken a century hence.

ESTIMATE OF COST.

Under any circumstances the creation, as it were, upon any scale of upwards of four hundred miles of internal navigation must be a matter involving immense outlay, and my estimate of the cost of carrying out the French River and Ottawa navigation project on the scale above laid down, amounts to the very large figure of twenty-four millions of dollars, or about five millions of pounds sterling.

The proportion of actual canalling on the route is not large; being about twenty per cent. less (Lachine Canal included) than on the Welland and St. Lawrence line of navigation. The quantities of material, also. to be excavated and removed will average less, mile for mile, on the former than was involved in the carrying out of the latter series of undertakings. So far, then, the average of physical advantage would seem to be in favor of the new project, and would be largely so in reality, were it not that the geological structure of the region watered by the upper Ottawa and its tributary the Matawan, by Lake Nippisingue and its outlet the French River, is such as to far more than counter-balance all the apparent facilities for construction which the proposed route presents as compared with the existing one.

The greater difficulties to be encountered on the former consists, first, in the hard unyielding nature of the material to be worked upon—the granite rocks—chiefly (according to the classification of Sir William Logan) syenite, gneissoid—syenite and gneiss, thrusting themselves forward harsh, naked, and repellant, over the whole of the more distant portions of the line. On the nearer sections, from the Chats Rapids to St. Ann, the formation to be dealt with, though of less impracticable character than that named above, is still rock,—rock everywhere.

The second great difficulty that presents itself in considering the improvement of these distant waters, where the major portion of the first-named and principal difficulty exists, lies in the inaccessibility of the region which they penetrate, the whole of which, in so far as relates to the sustaining of human life, may be called non-producing, little or none of it being as yet settled. This is a feature that must be kept in view, as one that must add largely to the cost of the undertaking, just as it now does the cost of "making lumber" on the Upper Ottawa and its tributaries.

When so comparatively small a portion of this long chain of navigation has been submitted to the test of instrumental survey, it would, of course, not be

possible to present an accurate and detailed estimate of the quantity of work to be executed at each point of interruption. General examination, however, joined to the results of the surveys as far as carried out, have enabled me to make such an estimate of the amount of excavation to be encountered as, allowing for all known difficulties and probable contingencies, warrant me in stating the cost of establishing the communication through from Montreal to Lake Huron at the amount already named.

The leading denominations of the work involved in the undertaking are, 1st, Rock Excavation ; 2nd, Dams ; 3rd, Locks.

I have considered all excavation from St. Ann upward as rock, and estimated the cost of removing it at from $2 to $4 per cubic yard. The dams, of timber and stone, after our Canadian fashion of "crib work," I place at $4 per cubic yard. A large portion of the canalling will be accomplished by means of these dams, and that too without incurring the disadvantage so often a consequence of that mode of improving river navigation—the drowning of valuable lands. As a general thing, save in the great hoist proposed to be given to Lake Nippisingue, the raised waters will merely wash their rocky boundaries at a higher level without acquiring any material increase of surface area. The locks, of masonry not inferior in quality to the highest standard on our existing canals, are provided for at an average of $10 per foot lift. Engineers who have had experience in the carrying out the hydraulic works of this continent, and those more especially who have gathered such experience on our noble St. Lawrence navigation, will, in comparing the above prices with the actual cost of similar works elsewhere, credit me with liberality in my views of the probable cost of constructing the works pertaining to the Ottawa and French River navigation scheme.

The cost of lockage on the main Ottawa River will be not a little affected by the necessity that will exist for providing lofty guard-locks at the entrances of some of the canals, because of the great fluctuations of the water ; the difference of level between extreme high and extreme low water reaching in some places to twelve feet; on no section of the river is it much less than six feet.

Before concluding on this question of cost, I will touch briefly on one other point bearing upon it in no small degree, viz: the facilities presented for procuring the materials requisite for construction.

The granitic formation, such as pervades the greater portion of the route, is not likely to furnish much material for those portions of the lock masonry, such as quoins, coping, &c., which will require to be finely cut; though the gneiss proper may be found well suited for the interior and many parts of the face work of the walls.

The Great Manitoulin Island, in Lake Huron, directly facing the mouths of the French River, abounds in limestone of superior quality. From there the structures on the river can be conveniently supplied with cut stone of any required dimensions ; the "backing" and certain portions of the face stone being, as suggested above, procurable from the necessary excavations for the locks, or in close proximity to them. It is more than likely that much of the material for the Matawan locks would also have to be transported from Lake Huron, and that could only be effected within reasonable limits of costs, after the completion of the French River works.

At two points only between the Georgian Bay and the confluence of the Matawan with the Ottawa, do I know of the limestone cropping out. On "Iron Island," (so named by Mr. Murray, Assistant Geologist) in Lake Nipissingue, and near the "Talon Chute," upon the Matawan. In neither instance does it present itself in strata of sufficient amplitude to promise much assistance towards the construction of the locks, unless in furnishing lime for such portions of the masonry as might not require to be laid in hydraulic cement mortar.

For the works upon the Ottawa, from the Matawan to Portage du Fort, I am not prepared to say where appropriate building stone may be most conveniently obtained. There are, however, quarries of fine limestone in Lac des Chênes, below the Chats Rapids, whence, as the several sections of canal advance towards completion, ascending the stream, material for the more distant improvements, at Les Deux Joachims, Le Rocher-Capitaine, Les Deux Rivières, &c., may be carried at reasonable expense, provided no nearer sources of supply should be discovered. This is the most unfavorable view that can be presented of this phase of the undertaking. The probability is that suitable material is to be found very much more convenient to the several points above-named, and that portion of the Matawan improvements also may be supplied from not far distant quarries on the Ottawa.

For the Chaudière Canal at Bytown, and all works on the lower Ottawa, building stone of unexceptionable quality is to be had close by.

After the locks, the dams are the parts of the work which will absorb the largest amount in wrought material, but fortunately, in no one instance will it be necessary to go to a distance for the timber and stone, which form the main elements of their construction. These are on the spot, in inexhaustible quantities, and labor only has to be provided for this class of work—the cost of which I have estimated at as high a rate as I have ever known similar work to amount to where the raw material formed a large proportion of the expense.

The St. Lawrence and Welland Canals cost per mile, not far from $150,000

The fifty-eight miles of Ottawa Canal (enlargement of Lachine included) I estimated at upwards of $370,000

per mile, and for the removal of shoals, hereinbefore referred to, I allow two and a quarter millions more, swelling the whole cost to $24,000,000

Equal in sterling money to £4,931,506

That the raising and expenditure of this large amount of capital should be entered upon all at once it is not the object of this report to recommend. The prosecution of the "Ottawa and French River Navigation" scheme must be a gradual and progressive work, advancing towards completion as we grow in wealth and national resources.

It is not, however, the money cost of the enterprise that will be so difficult to deal with in endeavoring to procure an impartial consideration of its merits as the remoteness and present inaccessibility of the district which it traverses. But an atom of our population belongs to the valley of the Ottawa, and to the mass of the people the whole of the region drained by that great river and by the basin of Lake Nippisingue is a *terra incognita*, supposed to be enveloped in frosts and snow for the greater part of the year, and, therefore, unsuited for the habitation of civilized man. Indifference to the facts of the case and consequent absence of correct information engender unbelief. The very name of "Canada" was wont but a few years since to suggest similar ideas to the minds of the people of New York and Massachusetts.

Viewing the project in detachment will disarm it of many of its terrors.—The canals of the lower Ottawa, for instance, from Bytown to Montreal, have to be enlarged—not made *de novo*. This section covers more than one-fourth of the whole route and embraces more than one-third of all the canalling.

Above the City of Ottawa (Bytown) the first canal—four miles in length—to connect the lower Ottawa with Lac des Chênes, has long been in contemplation, and a money appropriation has, in fact, been made for its commencement.—There are none but ordinary difficulties in the way of its construction, and no one having a knowledge of the locality can doubt but it must ere long be undertaken and carried out.

Beyond that again is the "Chats" canal—three miles long—to connect Lac des Chênes with Lac des Chats: This has already been commenced, and the works, though temporarily suspended, far advanced towards completion. The finishing of those two links in the chain will render the river continuously navigable for fifty-five miles from the City of Ottawa upwards to Portage du Fort.

From Portage du Fort to the "Grand Calumet" five miles of canal are wanting, and furthermore, at the "Calbute," two miles. The construction of these seven miles will not be more difficult than that of the equal length embraced in the Chats and Chaudière sections, and will add seventy-eight miles to the continuity of the chain, bringing us to the head of the "Deep River;" 143 miles above Bytown or 253 miles above Montreal; considerably more than half the entire distance covered by the project.

The head of the Deep River, at Les Rapids des deux Joachims, is also the head of steamer navigation on the Ottawa, and almost the last outpost of settled habitation.

There are a few isolated patches of settlement beyond, but though "lumbering" operations are largely carried on to a great distance further up the River, the sole means of transit is the canoe.

Seven miles of canal at and above "Les Joachims" would enable the forest-born steamer, now plying on the Deep River to ascend to the Matawan, 305 miles from Montreal; seven miles at and below the "Calbute" would allow her to descend into the Chats Lake; as regards the Ottawa itself, then those fourteen miles form the only portion of the proposed improvements, which have not yet been recognized by some decided action of the Legislature as necessary to the well-being of the commerce of that section of the Province. It is difficult to imagine that when the half finished canal at the Chats Rapids is completed we shall have reached the limit of our expansion in that direction.

Distant and inaccessible as the region of the Matawan, Lake Nippisingue and the French River may now appear to us, it is in reality no more difficult of access than was the forest country between Bytown and Kingston when first pierced, some thirty years ago, by Colonel By, in the construction of the Rideau Canal; nor, comparing now with then, are the obstacles to be encountered, generally, in the project under consideration of equal magnitude with those which he so bravely grappled with and so successfully overcame.

The practicability of the Caughnawaga Canal project is no longer a matter of opinion. We have surveys and estimates of cost, which place its entire feasibility beyond doubt. As a consequence of its construction, the people of the State of New York would be compelled to enlarge their "Champlain" Canal to corresponding dimensions; thus opening a complete water communication between the St. Lawrence above Montreal and the Hudson above Albany; in other words, a direct ship-navigation between Montreal and New York by way of Lake Champlain and the Hudson River. I would not like to assert that there is among us any commercial man taking broad views of the future of Canada in its connection with the trade of the west, who doubts for a moment that that line of communication is destined to be established; and yet it will involve the construction of upwards of thirty miles more of Canal than the route herein reported on as between Montreal and Lake Huron, besides the deepening of some ten miles of the Hudson River. There is no scepticism as regards the feasibility of the former project, even among those who may question its utility, simply because it relates to a section of the country with which we are all more or less familiar—where the forest has disappeared before the march of civilization; and where we have hitherto allowed no difficulties to arrest our progress in the mission of enterprise.

I have already stated the dimensions proposed for the locks of the Ottawa and French River navigation. For the canals, 100 feet wide on bottom is calculated in

long reaches—60 feet in short reaches, where vessels need never seek to pass one-another. The surface widths of water, the excavations being all in rock, would be about ten feet greater than the bottom widths; the depths to be from ten to eleven feet.

The deepening to full depth of much of the shallow portions of the waters might be very gradually carried out, but as hereinbefore observed, the sills of all locks should be laid at ten feet below the level of the lowest water; each successive step in the advancement of the undertaking being regarded but as a link in a great uniform and well digested scheme of navigation.

CLIMATE, SOIL, &c.

At each of the camps a careful meteorological record was kept, noting the temperature three times each day. The rain-fall and snow-fall were also recorded. Appendix "B" herewith gives in full the result of those observations.

The winter of 1856–7 was one of more than average severity all over Canada, and it will be seen from the tables that on the 23rd January, in the latter year, the mercury had descended to the point at which it freezes, 39° zero of Fahrenheit, and the cold on these occasions was estimated at from six to seven degrees lower. Not anticipating such extreme severity of temperature, the camps were only furnished with the ordinary quick silver thermometers.

The mean temperature of that, the coldest, month was:

	7 A.M.	2 P.M.	9 P.M.
On Upper Matawan.....	5.15	6.27	3.87
" Lower Matawan.....	8.06	8.35	1.03
" Ottawa below Fort William.....	6.74	13.00	2.49

The periods over which these records extend are as follows:

On Upper Matawan from 1st November, 1856, to 15th June, 1857.
" Lower " " " 31st May, "
" Ottawa " " " 28th Feb'y, 1858.

We had thus but one winter's experience on the Matawan, and that a particularly severe one. On the Ottawa, in the region of the Allumettes Island the records embraced nearly two winters; the second that of 1857-58, proving, as was the case throughout the province, very much milder on the whole than the first. For instance, in January, 1858, the mercury fell once as low as 17°. In February, which as it commonly is, was the coldest month that year, the extreme, and on but one day, was 25°. The average of the weather in that particular month (1858) having been more severe than in the corresponding month of the previous year; which, notwithstanding the general severity of the winter, was, in the western parts of the Province also, singularly mild for February. The table shews:

Mean temperature, February, 1857 ..... 19° 39′
" " " 1858 ..... 11° 74′

As regards the bearing which this question of temperature may have on the navigation in limiting its period of duration, I took much pains to ascertain for what portion of the year open water may be reckoned on throughout. The conclusions arrived at are: that the ice on the French River is never particularly strong; that the river is generally quite clear before the 1st May, and rarely closed till some time in December. That Lake Nippisingue is always open all through November, and the ice seldom strong enough to bear till towards the close of the following month, but once it "takes" it continues ice-bound to an advanced period in the spring, and has been crossed on foot as late as the 15th of May. This, however, is a very rare occurrence; my Indian informants having been able to recall but one such instance. From the 1st to the 5th May may be assumed as the ordinary period of dissolution of ice in Lake Nippisingue.

The Matawan was entirely open by 5th of May, 1857, which, as already observed, succeeds a winter of more than common severity. The Ottawa is generally

entirely free by the first of May, and often from a week to ten days before that time. The St. Lawrence Canals below Prescott, it will be remembered, are seldom ready for navigation sooner than the first of May.

Through the kindness of Captain Cumming of Aylmer, on the Ottawa, a gentleman of long experience in the navigation of that river, I have obtained a reliable return of the dates at which, for eleven years past, steamer navigation has commenced and closed each year. The earliest opening was in 1848, when the boats commenced their trips on the 18th April. The latest closing was in 1854, on 1st December. The average for the eleven years referred to 1847 to 1857 inclusive, is,

Commencement of Navigation ..... 27th April.
Closing of do ..... 27th November.

And as a general thing, the steamers might have continued to run during part of December, had the trade of the river warranted their owners in not laying them up.

The season of water-borne traffic between Montreal and the Western Lakes is at present governed, as to duration, by the period at which the lower links in the St. Lawrence improvements—the Beauharnois and Lachine Canals to wit—open and close. The former period is not often earlier than the 1st of May; the latter as seldom goes beyond the 30th November. It will be observed, then, from the dates already given, in reference to the assumed season of open water on the Ottawa and French River route, say from 5th of May to 27th November, that the balance against it in the actual number of days navigation in the year cannot be very great, while practically, and in point of available time, it can claim an advantage over the lake route, from the fact that, owing to the lesser distance to be travelled, a vessel could make at least three trips more in the season between Chicago and Montreal by the former than it could by the latter route.

In Canada and the neighbouring States the season of canal navigation is commonly considered to be 200 days. From an average of eight years, I find the Welland Canal to be open 209 days in the year (Sunday being a *dies non*), and the Erie Canal, in the average of the same years, 1850 to 1857 inclusive, for 195 days. I do not venture to calculate on more than 180 days for the navigation of the Ottawa line, but, as I have endeavored to show on page of this report, it should have on each trip a gain in point of time of forty-four hours over the Welland and twenty-four hours over the Toronto and Georgian Bay route.

Appendix letter C gives the dates of opening and closing of navigation on the Welland and Erie Canals, and on the used portions of the Upper Ottawa for a number of years immediately preceding the current one.

In its agricultural capabilities the valley of the Ottawa presents a striking and unfavorable contrast to the almost uniformly fertile aspect of the country watered by the St. Lawrence and bordering the Great Lakes.

From St. Ann upwards the lower Ottawa exhibits varied features of fine cultivable lands and bold mountain scenery.

On the upper section of the river also, for one hundred miles above the City which bears its name, a fair proportion of well tilled farms and comfortable homesteads meet the eye of the traveller, together with tracts of wild land that will well repay the labor of clearing.

From the westerly limits of the County of Renfrew, the last outpost of surveyed settlement on the south side, ridges of area sand or frowning rocky mountains, border the waters. Forests of pine, from which the large timber has already been chiefly culled out, prevail everywhere, save where the cold, naked granite refuses even the scanty nourishment that suffices to induce the growth of the Norway fir, or its hardy companion, the white birch.

The traveller, however, who judges the country only by what can be seen of it from the river as he glides past in his canoe, does not form a fair estimate of its adaptability to the uses of civilization. The worst of it is along shore on both sides. The interior possesses large tracts of good hardwood land in the valleys of the

mountains on the north side, or stretching in broad belts, towards the lake country, on the south.

Still the impartial chronicler, when he has completed his tour of the river, must record his opinion that the destiny of the valley of the Ottawa is not to be a parallel one to or of the same inviting character as that of the St. Lawrence Valley, with its rich alluvial soil and broad wheat growing districts; but, having faith in the future of his country, he will at the same time predict that the former section has awaiting it a destiny not second in national importance to that of the more favored region, as to soil and climate, which constitutes the latter section, and that with our great northern river for the spinal column, Canada must gradually gain the strength and vigor which length without breadth can never confer. As yet we represent but an attenuated frontier settlement, fringing a thousand miles of exposed and unprotected coast, but our position on the map of the continent is a distinctive and impregnable one. The lakes and the noble St. Lawrence defining our limit of expansion to the south, the polar regions bounding us in rear, we are the "Northmen" of America. Our national growth may be slow, but it will be healthy and enduring. Here the surplus population of the British Isles may, for centuries to come, find scope for their genius and their industry, and transplanting with them to congenial soil the laws and principles of the mother country—here for ever may her

"Freedom spread unfevered and serene."

A striking feature in the conformation of the Ottawa is the concentration of the greater proportion of its descent into short, abrupt rapids, or almost perpendicular falls, at distances of from fifteen to fifty miles apart, over the entire length embraced in the proposed scheme of improvement: forming at each point water power of singularly easy adaptation to manufacturing purposes and of unlimited extent. In the city of Ottawa alone the available power almost defies computation; the whole volume of the mighty river here pours over a natural weir or dam of forty feet in height, while into the basin below the cataract flow two large tributaries. The "Rideau," entering from the south, falls perpendicularly from a height of fifty-four feet. On the north the "Gatineau" comes in, presenting mill site after mill site as it stretches far away into the unexplored forest.

This rising City, the future metropolis of United Canada—of United British North America perhaps—with the Ottawa and French River navigation completed, would be nearer by at least 100 miles to Chicago than Buffalo is by water carriage, and with a branch of the Grand Trunk Railway direct to Montreal, and the Victoria Bridge finished, it would also be nearer by at least 30 miles to an Atlantic Port (Portland) and over a continuous line of Rail, than Buffalo, the "Queen City" of Lake Erie, is to New York.

The Ottawa country abounds in iron ore of the richest description. Its forests of pine are inexhaustible. Its water power, as already stated, not only unlimited in capacity but available to its full extent at numberless stages upon the route. By the opening of the projected navigation this great manufacturing agent would be brought into comparative proximity to the granaries of Lake Michigan, and would immediately be turned to account in preparing the cereals of the west for the markets of the east. With such a combination of advantages in possession or in prospect, it is surely not difficult of belief that the valley of the Ottawa is destined to be not only the workshop of Canada, but one of the chief manufacturing districts of America.

The country bordering the Matawan, Lake Nippisingue, and the French River, corresponds very closely in character to that on the uppermost sections of the Ottawa; all that can be seen from the waters is harsh and barren, but in the interior are broad tracts of good land. The whole region is beautifully watered and in the highest degree healthy; fever and ague, those scourges of the new settlements in the rich alluvial districts along the Great Lakes, and on the prairies of the west, being wholly unknown. In fine, like the granite regions elsewhere

upon this continent, the granite regions of Canada are capable of producing and maintaining a hardy, industrial, enterprising and self-reliant race of men.

I have before said, that in investigating the important question submitted to me by the Commissioners of Public Works, it was not my intention to enter largely into the compilation of statistics, deeming rather that I would best follow out my instructions by confining myself chiefly to the acquisition of the materials necessary to enable me to pronounce on the practicability of the undertaking, and I trust that I have to some extent succeeded in showing that the interior of our country is not wholly without hope in the future. To those who have made the laws that govern the movements of western traffic their study I leave it to them to estimate the height to which the commercial position of Canada would be elevated by opening through the heart of her dominion an uninterrupted water communication, shorter by hundreds of miles than any that now does or ever can exist besides, between the Atlantic coast and the greatest extent of fertile country in the world.

With the commerce of a continent pouring down the valleys of our two great rivers (by rail as well as by water), and centering in Montreal, that City and Quebec could not fail to become the principal entrepôt of merchandise for the north and west, and our eastern lines connecting them with one another and the sea-board, would then cease to be stigmatized as unproductive appendages to our national railway.

In concluding this report I would beg leave to observe that the survey, entered upon with a view to comprehensive results, having been brought to a somewhat abrupt termination, the work necessarily remains in an unfinished condition. The greatest pains have, however, been taken to fix permanently on the ground the principal points in the triangulation; so that at any time for some years to come the several positions of the survey commenced and abandoned may be taken up where left off and continued to completion without the necessity of going over again with the instruments ground that has already been carefully triangulated and waters that have been accurately sounded at great expense.

My principal assistant in the general management of the surveys was Mr. James Stewart, a gentleman whose skill and experience as a Hydrographical Surveyor have been long known to the Department. Mr. George H. Perry had immediate charge of the section between Fort William and Portage du Fort, and during two severe winters and one hot summer displayed untiring energy and zeal in pushing forward the work. The two parties on the Matawan were in charge of Mr. H. Munro Mackenzie, and Mr. Robert Shanly, respectively: the former gentleman completed the triangulation and soundings of the river from the mouth to the head of Lake Talon, and is familiar with it in all its bearings in that distance of twenty-six miles.

The latter knows the river intimately in its entire length, having run the levels throughout, and made the surveys of its upper section as well as of the dividing ridge between its waters and those which flow to the west; with the topography of the summit barrier and of the adjacent shores of Lake Nippisingue he is also thoroughly acquainted.

All of the gentlemen above named took the deepest interest in the work, continuing under all the trying conditions of camp life in the forest, the thermometer ranging from forty-five degrees below to ninety-seven degrees above zero, to discharge the duties assigned them with a zeal, ability and patience to which I bear most willing testimony.

The whole is respectfully submitted, and

I remain, Sir, your obedient servant,

T. A. Begly, Esq., Secretary Public Works, Toronto.

(S'd.) W. SHANLY.

APPENDIX A.

Section of Waters on French River and Ottawa route—Lake Huron to Montreal.

Names of Lakes, Rivers, and Rapids.		Details. Distance in miles.	Rise in feet.	Fall in feet.	Totals. Distance from Montreal.	Elevation above Tide water.
Lake Huron		..	..	..	430	572
French River (still water)	French River.	1 2/4	..	..	428 1/4	572
Les Petites Dallé's Fall		..	6 1/2	..	428 1/2	578 1/2
French River (current)		16	1 1/4	..	412 1/4	599 3/4
Grand Recollet Fall		..	7	..	412 1/4	586 3/4
French River (current)		18	1 1/4	..	394 1/4	438
Grand Fausse-Isle Rapid to Des Pins Rapid		4	18	..	390 1/4	606
French River (still water)		9	..	..	381 1/4	606
Chaudière Rapid		1/4	26	..	381	632
Lake Nippisingue	La Riviere de Vase.	30	..	..	351	632
Rivière de Vase (still water)		1	..	..	350	632
do (current)		1/2	5 3/4	..	349 1/3	637 3/4
Rapid		..	9 1/4	..	349 1/2	647
Rivière de Vase (still water)		1/2	..	..	349	647
Rapid		..	4	..	349	151
Rivière de Vase (current)		1	1 1/4	..	348	651 1/4
Creek (current)		1 1/2	5	..	346 3/4	656 1/4
Rapid		1/2	2 1/2	..	246 1/4	658 3/4
Lagoon		1/4	..	..	346	658 3/4
Portage { Summit		1/2	8 1/4	..	345 1/3	657
Portage { From thence to Trout Lake (distance about 400 feet)		..	..	12	345 1/2	655
Trout Lake connecting Rapid at Turtle Lake	River Matawan.	12 3/4	..	1 1/4	332 3/4	653 3/4
River Matawan—Rapids with reaches of still water		4 1/4	..	31 1/2	328 1/2	622 1/4
Lac Talon		7	..	..	321 1/2	622 1/4
Talon Chute		1/4	..	42 3/4	321 1/4	579 1/2
Eel Lake		1 1/4	..	..	320	579 1/2
River Matawan—Rapids with reaches of still water		1 1/2	..	21 1/4	318 1/2	558 1/4
Paresseux Rapids and Chute		1/4	..	34	318 1/4	524 1/4
Lac des Aiguilles		3	..	..	315 1/4	524 1/4
Rapid des Aiguilles		1/4	..	6	315	518 1/4
River Matawan (current)		1 1/4	..	1/2	313 3/4	517 3/4
Rapid de la Rose		1/4	..	6	313 1/2	511 3/4
River Matawan (still water)		1/4	..	..	313 1/4	511 3/4
Rapid des Epines		1/4	..	6	313	505 3/4
Lac Plein Chants		5 1/2	..	..	307 1/2	505 3/4
River Matawan Rapids with reaches of still water to mouth		2 1/2	..	20 3/4	305	485
Rapids on Ottawa at mouth of Matawan	River Ottawa.	2	..	5	303	480
River Ottawa (current)		17	..	9	286	471
La Veillée Iron and Deux Rivières Rapids		3	..	32	283	439
River Ottawa (current)		10	..	5	273	434
Rocher Capitaine Rapid		2	..	45	271	389
River Ottawa (current)		16	..	8	255	381
Joachim's Rapid		2	..	28	253	353
River Ottawa ("Deep River") perceptible current at foot of Joachim's Rapid only		23	..	2	230	351
do (current)		11	..	1	219	350
Culbute and L'Islet Rapids		2	..	18	217	332
River Ottawa (by Lake Coulonge and Calumet Channel current generally		42	..	7	175	325
Grand Calumet Rapids		2	..	56	173	269
River Ottawa—Rapids with reaches of still water to Portage du Fort		8	..	42	165	227
Lac des Chats		18	..	1	147	226
Chats Rapids		3	..	50	144	176
Lac des Chênes		28	..	..	116	176
Chaudière Rapids		6	..	67	110	109
River Ottawa (still water)		54	..	..	56	109
Long Sault Chute au Blondeau and Carillon Rapids		12	..	48	44	61
River Ottawa (Lake of the Two Mountains, still water)		20	..	..	24	61
St. Ann Rapid		1/2	..	3	23 1/2	58
Lake St. Louis		15	..	..	8 1/2	58
Lachine Canal to Montreal		8 1/2	..	45	0	13

APPENDIX

Abstract from Register of Temperature,

1856.

Day of Month.	November.					December.					January.					February.				
	Temperature.			Depth in inches.		Temperature.			Depth in inches.		Temperature.			Depth in inches		Temperature.			Depth in inches.	
	7 a. m.	2 p. m.	9 p. m.	Rain.	Snow.	7 a. m.	2 p. m.	9 p. m.	Rain.	Snow.	7 a. m.	2 p. m.	9 p. m.	Rain.	Snow.	7 a. m.	2 p. m.	9 p. m.	Rain.	Snow.
1...	32½	39	39	...	...	14½	27	26½	...	1·80	19	24	19	...	...	7	12	5	...	0·50
2...	33	39½	44	...	...	6	12	8	...	0·30	14½	21	19	...	0·30	6	0	10	...	...
3...	39	38½	41	0·70	...	14	16½	10	...	2·00	18	21	17	...	0·50	18	7	14	...	0·80
4...	35	36	24	0·90	...	4	8	10	...	...	12½	15½	3	...	...	18	20	13½	...	1·00
5...	18	25	16	...	0·70	10	16	12	...	...	18½	2½	20	...	...	14	19	31	...	0·25
6...	24	27	32	...	...	8½	20½	6	...	0·50	31½	10½	24	...	...	28½	34	33	...	0·20
7...	32	45½	48	...	...	1	8½	5½	...	...	14	14	23	...	...	45	51	52	0·60	...
8...	51	30½	24	0·70	0·10	0	13	2	...	...	33	14	14	...	...	32	17	8½	0·30	0·10
9...	17½	27½	25	...	...	5	17½	10½	...	...	3	19	11	...	0·20	5½	16½	17	...	0·10
10...	24	35½	30	...	...	15	29	25	...	...	13	19	4	...	0·10	8	5	9½	...	0 80
11...	30	37	30	...	0·90	27	35	35	0·20	...	14½	½	16	...	...	21	5½	16½	...	0·10
12...	32	38	28	...	...	31	32	29	...	...	17½	9½	20½	...	...	16	17	15½	...	0·25
13...	27½	33½	33	...	...	19	19½	17	...	...	19½	23	13	...	0·30	34	30	19	...	0·30
14...	28	30½	29	...	...	15	18	7	...	5·30	4	4	6	...	...	11½	26½	36	0·10	...
15...	22	32	29½	...	...	9	3	15	...	0·40	17	4	11	...	...	35	38	35½	0·10	...
16...	28	31	20½	...	1·20	6	7	8	...	0·30	2½	19½	15½	...	0·60	35	42	36½	0·20	...
17...	21	28	26½	...	0·70	28	14½	27½	...	...	8½	12	28	...	0·10	36	47	41	0·20	...
18...	24	28	19	...	...	34	11	22	...	...	34	6	20	...	...	13½	16½	14	...	0·10
19...	22	26	23	...	...	6	2½	6	...	2·00	9	7	3	...	...	14	24	16½	...	...
20...	23	30	30	...	...	24½	30½	18	...	2·25	3	9	9	...	0·60	6½	30	25	...	1·00
21...	23	34	34	...	...	3	11	12½	...	0·30	9½	10½	12½	...	0·75	20	35	22½	...	2·50
22...	36½	39	45	0·30	...	15	15½	10	...	...	29½	20	30½	...	...	14	29½	29½	...	0·20
23...	32	40½	42	...	...	3½	9½	4	...	...	46	24½	34	...	...	30	39	32	...	0·20
24...	33	38	32	...	...	2	8	4	...	...	15	7	7	...	0·40	31½	45	40½	0·50	...
25...	30½	31	30	...	2·10	8	8	5	...	0·20	25	3	18	...	...	33	31	15	...	...
26...	29	33	26	...	1·50	6	11½	3	...	1·25	½	12	18	...	0·20	9½	17	5	...	...
27...	30	29	20	...	0·20	6	11½	9	...	...	23	20	11	...	...	6½	21	19	...	...
28...	7	21	14½	...	...	9	14½	16	...	3·50	8	25	9	...	...	6½	26	1	...	1·50
29...	15	28	19	...	1·00	16½	21	21½	...	1·30	6	19	0	...	0·10	...	...	...	...	...
30...	18½	19½	5	...	...	18	29	23	...	1·20	14½	2	4	...	...	...	...	...	...	...
31...	...	...	...	...	...	22	27	22	...	0·50	6	17	15	...	0·70	...	...	...	...	...
				2·60	8·40	...	...	...	0·20	23·10	...	...	...	...	4·85	...	...	...	2·00	9·90
	2·727	32.50	28·63	...	...	5·89	14·53	8·81	...	...	5·15	6·27	3·87	...	...	14·54	24·30	19·34	...	...
		29.47		...	...		9·74		...	...		0·92		...	...		19·39		...	...

B.

&c., kept on the Upper Matawan.

1857.

March.					April.					May.					June.				
Temperature.			Depth in inches.		Temperature.			Depth in inches.		Temperature.			Depth in inches.		Temperature.			Depth in inches.	
7 a. m.	2 p. m.	9 p. m.	Rain.	Snow.	7 a. m.	2 p. m.	9 p. m.	Rain.	Snow.	7 a. m.	2 p. m.	9 p. m.	Rain.	Snow.	7 a. m.	2 p. m.	9 p. m.	Rain.	Snow.
6	16⅔	4	...	0·10	13	22⅓	8½	...	1·00	40½	47	42½	0·10	...	53	63½	54	0·84	...
15	3⅓	7½	...	...	11	27	17	...	...	39	39	34½	...	...	55	55	47½	0·22	...
10½	16	15½	...	1·50	12	41½	29	...	...	37	62½	33	...	...	47	56	44	0·05	...
9½	29	21	...	0·20	34½	43	27⅔	...	...	39	63	46½	...	...	44	53	40	0·01	...
23	32	19½	...	1·75	40	44	30	1·00	0·10	32½	35½	33	...	0·50	44	53	48	0·05	...
10	10	1	...	0·10	13	22	11	...	3·50	35	42	35	...	0·20	48	64	49	0·35	...
9	6⅔	9	...	...	12	33½	13	...	0·50	35	63½	35½	...	...	49	73	50	...	...
15	15⅔	5	...	...	23	29	27	...	1·50	35	69½	44	...	...	60	73	57	0·05	...
11	21⅔	9	...	1·00	30	44	26½	...	...	43	72½	53	0·35	...	59	83	57	...	...
14½	14	6	...	...	27	43	30½	...	...	36	31	25	0·25	1·00	62	79	57	...	...
9	24½	11	...	0·20	25	43	29	...	...	19	43	28½	...	...	58	71	60	...	...
3	17	1½	...	...	31	50	26½	...	...	30½	61	32	...	...	54	71	58	...	...
11	34	25	...	...	27½	53½	30	...	...	37	71	39	...	...	56	67	44	...	...
23	31	9	...	1·00	37	51	35	...	...	47	60	46	...	...	49	64	44	...	...
2	33	14	...	...	33	45½	28½	...	0·30	49	70½	48	...	...	56	66	57	...	...
10	41½	27½	...	...	24½	33	25	...	0·30	43	50	34	0·10	0·50	57	60	53	0·10	...
19	35	16	...	0·30	30	43	26	...	...	42½	61	41	...	3·50	53	53	53	1·32	...
20½	28	23	...	3·75	27	42½	33	...	...	46	64	40	...	...	NOTE.—This Register ends abruptly on 17th June, in consequence of the Matawan Survey having been stopped.				
18	37	26	...	...	38	34½	32½	...	0·50	47	56	39	...	...					
16½	44	30½	...	...	34½	43	34	...	0·15	51½	70	49	...	...					
30⅓	40	24	...	1·75	35½	59½	41	...	...	58	84	49½	...	...					
16	48½	32½	...	...	33	47	33	...	...	50	81½	54½	...	...					
34	37½	35	0·10	...	29	48	33	...	...	52½	84	56½	...	...					
31	33½	27	...	1·50	33	49½	31	...	...	61	86	60	...	...					
21	31	23⅓	...	1·00	33½	51	29	...	...	55	79	51	...	...					
22	42	30¼	...	0·25	35	62	37½	...	...	52	69	59	...	...					
27	47	33	...	...	33½	36½	32½	...	0·70	60	67	56	0·35	...					
32	41	32	...	...	26½	37½	27½	...	...	58	57	47	0 10	...					
33	46	27	...	...	31	50½	27	...	...	44½	53	47	0·26	...					
25	44½	27	...	...	29	62½	32½	...	...	47	67	47	0·30	...					
27	56⅔	36	...	...	..	...	...	...	...	45	65½	56	...	...					
...	...	...	0·10	14·40	...	...	...	1·00	8·55	...	...	...	1·81	5·70	Fall each month of Rain and Snow.				
11·74	30·87	17·82	...	...	28·07	43·08	28·12	...	...	44·11	62·10	43·94	...	...	Means of Temperature.				
20·14			...	...	33·09			...	...	50·05			...	...	Mean Temperature of each month.				

APPENDIX

Abstract from Register of Temperature,

Day of Month.	1856. November. Temperature. 7 a. m.	2 p. m.	9 p. m.	Depth in inches. Rain.	Snow.	December. Temperature. 7 a. m.	2 p. m.	9 p. m.	Depth in inches. Rain.	Snow.	January. Temperature. 7 a. m.	2 p. m.	9 p. m.	Depth in inches. Rain.	Snow.	February. Temperature. 7 a. m.	2 p. m.	9 p. m.	Depth in inches. Rain.	Snow.
1...	32	37	29	...	0·50	9	30	26	...	0·30	18	25	20	...	0·40	11	15	4	...	2·50
2...	33	51	43	...	...	13	14	6	...	0·20	16	23	19	...	1·00	5	6	15	...	...
3...	39	39	43	0·60	...	12	18	11	...	2·10	18	25	18	...	2·30	24	9	11	...	1·00
4...	36	37	27	0·80	...	2	10	9	...	...	13	15	3	...	0·30	12	20	12	...	1·20
5...	18	25	19	...	1·30	11	22	11	...	...	16	0	19	...	...	12	17	17	...	0·20
6...	25	40	33	...	...	2	18	11	...	1·70	34	5	26	...	...	32	33	35	0·10	...
7...	32	46	37	...	...	0	10	6	...	...	24	10	23	...	...	44	53	2	0·20	...
8...	51	33	23	0·70	0·20	4	13	3	...	0·10	32	6	18	...	...	35	18	8	0·10	0·30
9...	17	31	24	...	...	8	17	4	...	...	5	21	16	...	0·70	7	17	7	...	...
10...	23	40	30	...	...	6	23	19	...	...	15	19	5	...	0·50	7	4	11	...	1·10
11...	29	33	31	...	1·40	20	34	34	0·20	0·30	12	3	17	...	0·10	24	1	17	...	...
12...	32	37	30	...	...	33	33	31	0·10	0·10	20	8	21	...	0·10	19	17	14	...	0·20
13...	27	34	33	...	0·30	20	21	14	...	...	21	19	13	...	0·50	32	30	19	...	0·30
14...	28	34	27	...	...	12	17	16	...	6·30	4	6	3	...	...	10	22	36	...	...
15...	19	33	30	...	...	8	1	15	...	0·90	16	0	18	...	...	37	38	34	0·20	...
16...	28	33	20	...	1·80	8	7	1	...	0·30	0	20	15	...	0·60	34	46	36	0·10	...
17...	20	29	25	...	0·90	22	12	24	...	...	12	12	18	...	0·60	34	48	46	...	...
18...	24	31	18	...	0·20	36	13	24	...	...	40	4	17	...	...	16	22	16	...	...
19...	21	27	22	...	...	13	2	4	...	1·60	11	14	4	...	...	8	23	18	...	...
20...	22	32	29	...	...	12	30	22	...	1·90	0	9	6	...	2·60	4	30	24	...	0·90
21...	23	42	30	...	0·05	7	14	11	...	1·00	9	14	11	...	1·70	20	34	26	...	2·50
22...	37	41	37	0·40	...	13	14	8	...	...	...	...	...	...	...	10	32	30	...	0·20
23...	30	40	33	...	0·05	4	8	5	...	...	...	...	...	...	...	30	36	34	...	...
24...	32	39	32	...	...	1	5	0	...	...	...	...	...	...	0·30	30	43	44	0·20	...
25...	30	32	30	...	4·00	3	7	3	...	0·20	...	...	...	...	...	34	32	18	...	...
26...	29	31	28	...	2·40	7	14	4	...	1·10	...	...	...	...	0·30	9	20	6	...	...
27...	28	30	31	...	1·10	7	12	9	...	...	2	11	...	...	...	6	21	20	...	...
28...	5	24	15	...	...	9	14	14	...	3·10	5	...	9	...	...	6	17	...	...	1·80
29...	12	23	32	...	0·80	15	22	19	...	1·30	...	21	...	...	...	...	...	...	...	...
30...	20	20	7	...	0·30	18	29	33	...	0·90	23	6	4	...	...	...	...	...	...	...
31...	...	...	...	...	...	21	27	22	...	1·00	4	15	5	...	1·20	...	...	...	...	...
				2·50	16·30	...	...	...	0·30	24·40	...	...	...	...	13·10	...	...	...	0·90	12·20
	26·73	34·13	28·27	...	...	4·97	14·87	9·39	...	...	8·06	8·35	1·03	...	...	13·57	25·86	19·07	...	...
		29·71		...	...		9·74		...	...		0·25		...	...		19·17		...	...

B.

&c., kept on the Lower Matawan.

1857.

March.					April.					May.				
Temperature.			Depth in inches.		Temperature.			Depth in inches.		Temperature.			Depth in inches.	
7 a. m.	2 p. m.	9 p. m.	Rain.	Snow.	7 a. m.	2 p. m.	9 p. m.	Rain.	Snow.	7 a. m.	2 p. m.	9 p. m.	Rain.	Snow.
8	21	2	...	...	14	21	8	...	1·00	39	52	40	0·20	...
16	11	6	...	...	8	31	17	...	...	39	41	34	...	...
10	19	16	...	0·30	13	45	31	...	0·40	36	58	30	...	...
13	29	18	...	...	34	50	26	...	...	34	67	45	...	...
22	31	26	...	1·60	38	48	38	0·60	...	32	37	32	0·12	5·00
10	18	1	...	...	14	22	18	...	5·20	33	43	33	...	1·60
7	10	9	...	...	11	29	20	...	...	33	57	32	...	...
20	20	5	...	...	21	27	24	...	...	30	69½	44	...	...
9	27	10	...	0·80	28	41	26	...	...	43	72½	49	0·60	...
15	17	5	...	...	32	47	32	...	...	36	32	25	...	0·80
9	27	12	...	...	20	46	29	...	...	20	40	28	...	...
2	25	3	...	...	25	51	25	...	...	26	50	33	...	...
13	33	25	...	...	21	53	31	...	...	34	64	35	...	...
20	32	10	...	1·50	34	48	34	0·05	...	32	58	42	...	...
7	37	17	...	...	33	47	30	0·32	...	48	62	44	...	...
7	38	28	...	...	23	28	26	...	0·40	37	57	32	...	2·00
21	34	18	...	...	25	40	26	...	...	33	63	35	...	...
19	26	26	...	2·90	19	47	32	...	...	35	57	38	...	...
16	29	26	...	...	34	35	33	0·50	0·40	40	63	36	...	...
9	42	26	...	...	33	43	34	0·04	...	43	67	37	...	...
26	38	24	...	2·20	35	61	38	0·05	...	47	67	38	...	...
13	48	32	...	...	33	43	34	...	...	48	80	48	...	...
32	34	35	0·04	0·30	31	44	32	...	...	49	75	44	...	...
32	36	28	...	2·20	30	50	29	...	...	52	20	49	...	...
21	35	24	...	0 10	31	51	28	...	...	55	75	44	...	...
21	45	31	...	...	24	54	36	...	...					
26	48	32	...	...	34	37	32	0·64	...					
31	44	33	...	...	27	38	25	...	...					
31	44	24	...	...	30	42	24	...	...					
17	46	25	...	...	30	59	28	...	...					
19	52	38	...	...	...	...	...	...	...					
...	...	...	0·04	11·90	...	...	...	2·20	7·40	Fall each month of Rain and Snow.				
9·94	32·13	18·23	...	...	26·13	42·60	28·20	...	...	Means of Temperature.				
	20·10		...	...		32·31		...	...	Mean Temperature of each month.				

NOTE.—This Register ends abruptly on 25th May, in consequence of the Matawan Survey having been stopped.

APPENDIX

Abstract from Register of Temperature, &c., kept on the

Day of Month.	1856. November. Temperature. 7 a. m.	2 p. m.	9 p. m.	Depth in inches. Rain.	Snow.	December. Temperature. 7 a. m.	2 p. m.	9 p. m.	Depth in inches. Rain.	Snow.	January. Temperature. 7 a. m.	2 p. m.	9 p. m.	Depth in inches. Rain.	Snow.	February. Temperature. 7 a. m.	2 p. m.	9 p. m.	Depth in inches. Rain.	Snow.
1...	30	35	44	...	0·10	...	20	18	...	...	16	18	16	...	0·20	12	20	2	...	0·20
2...	42	50	44	0·10	...	14	19	8	...	0·30	16	24	18	...	0·20	8	9	24	...	...
3...	44	45	45	0·50	...	16	22	16	...	2·70	16	27	18	...	1·10	26	12	10	...	...
4...	46	53	44	0·15	...	4	16	7	...	...	11	22	8	...	0·10	16	32	18	...	0·70
5...	22	29	22	...	0·10	8	22	14	...	...	16	8	10	...	...	15	24	21	...	0·60
6...	20	40	32	...	...	16	22	16	...	2·00	24	4	20	...	...	24	45	36	...	...
7...	32	52	48	...	...	2	10	6	...	...	34	3	20	...	...	48	58	48	...	...
8...	35	48	32	0·20	...	2	14	6	...	...	32	3	16	...	...	46	32	14	0·1	...
9...	21	34	24	...	...	1	18	...	...	...	6	23	13	...	0·40	4	24	11	...	0·10
10...	18	32	24	...	...	8	26	18	...	...	16	24	14	...	1·00	...	3	15	...	1·50
11...	24	26	28	...	2·00	22	34	38	0·15	...	2	10	7	...	...	21	10	22	...	...
12...	27	47	34	...	...	36	36	22	0·05	...	24	8	12	...	...	16	15	4	...	...
13...	30	38	37	...	0·50	22	23	16	...	...	16	24	16	...	1·50	24	34	28	...	...
14...	28	37	37	...	...	13	20	28	...	8·50	11	14	2	...	...	13	34	22	...	...
15...	8	36	26	...	...	6	2	8	...	1·50	20	7	28	...	...	38	46	28	...	...
16...	28	32	26	...	4·00	2	8	2	...	1·20	6	18	10	...	...	40	46	35	...	...
17...	22	30	27	...	0·20	18	14	26	...	...	5	10	34	...	...	35	49	40	...	...
18...	24	32	22	...	...	36	14	28	...	...	44	2	32	...	...	28	25	25	...	...
19...	19	34	22	...	...	20	4	...	...	0·90	18	8	3	...	...	20	32	16	...	0·10
20...	20	32	22	...	...	12	19	32	...	1·00	16	8	4	...	...	16	32	30	...	2·00
21...	22	27	24	...	...	14	16	1	...	...	10	28	2	...	3·10	26	37	36	...	2·00
22...	38	47	36	0·30	...	10	16	7	...	...	30	15	32	...	...	29	46	40	...	...
23...	26	43	32	...	...	...	10	...	...	0·20	46	16	46	...	...	36	38	44	...	...
24...	27	48	43	...	...	16	8	4	...	...	22	1	6	...	0·30	36	48	52	2·00	...
25...	33	32	30	...	4·00	...	3	2	...	12·00	27	24	22	...	...	42	51	19	...	...
26...	33	36	30	...	0·10	...	12	10	...	0·60	12	18	12	...	...	11	25	5	...	...
27...	28	34	22	...	0·30	10	14	9	...	...	22	30	26	...	...	2	26	17	...	...
28...	12	23	10	...	...	10	17	14	...	1·50	19	26	4	...	...	13	27	2	...	3·50
29...	14	20	15	...	1·80	18	23	6	...	1 20	10	22	12	...	...	...	...	...	...	...
30...	18	24	14	...	...	18	34	23	...	...	8	10	4	...	...	...	...	...	...	...
31...	...	...	...	...	...	14	30	18	...	0·20	4	18	4	...	0·40	...	...	...	...	...
				5	13·10	...	...	...	0·20	33·80	...	...	...	...	8·30	...	...	...	2·10	10·70
	26·37	36·60	29·37	...	...	4·58	15·54	9·00	...	...	6·74	13·00	2·49	...	...	18·25	31·32	19·71	...	...
		30·70		...	...		9·70		...	...		1·26		...	...		23·09		19·71	...

B.

Ottawa between Fort William and Portage du Fort.

1857.

March.					April.					May.					June.					
Temperature.			Depth in inches.		Temperature.			Depth in inches.		Temperature.			Depth in inches.		Temperature.			Depth in inches.		
7 a. m.	2 p. m.	9 p. m.	Rain.	Snow.	7 a. m.	2 p. m.	9 p. m.	Rain.	Snow.	7 a. m.	2 p. m.	9 p. m.	Rain.	Snow.	7 a. m.	2 p. m.	9 p. m.	Rain.	Snow.	
12	29	10	...	...	22	24	12	...	2·00	50	56	46	0·10	...	60	68	59	0·40	...	
14	28	2	...	...	8	36	20	...	...	46	50	38	0·30	...	62	65	54	0·20	...	
15	22	22	...	0·50	18	50	34	...	...	38	72	46	...	...	56	68	52	...	...	
14	31	16	...	0·10	30	68	30	...	...	50	56	42	0·10	...	49	58	48	...	...	
22	36	32	...	0·10	42	56	30	...	...	40	48	36	0·80	...	54	62	50	...	...	
20	28	8	...	0·50	32	25	18	1·00	4·00	40	46	42	...	...	50	54	56	...	...	
3	13	2	...	...	18	31	13	...	3·00	49	66	44	...	...	56	70	58	...	...	
18	18	10	...	...	18	32	19	...	...	53	66	56	...	...	62	78	64	...	...	
16	19	14	...	4·20	33	44	30	...	...	58	70	46	...	...	66	74	70	...	...	
6	16	9	...	3·00	38	43	38	...	...	52	44	32	1·00	1·20	68	69	68	...	...	
8	33	3	...	...	34	60	42	...	...	28	48	34	...	...	68	66	60	0·60	...	
9	14	4	...	...	40	54	40	...	...	26	60	28	...	...	62	72	64	0·50	...	
12	38	30	...	...	42	50	42	...	...	36	71	46	...	...	62	66	54	...	...	
28	33	24	...	...	40	50	34	4·00	...	56	70	56	...	...	50	80	52	...	...	
20	37	24	...	...	46	54	38	3·00	...	59	72	54	...	...	54	70	54	...	...	
18	48	32	...	...	32	41	31	...	2·00	52	74	44	0·35	...	68	60	58	...	...	
28	38	24	...	...	42	48	38	...	...	38	54	46	0·75	0·20	52	56	70	...	...	
24	40	35	...	...	42	50	44	...	...	59	73	53	...	...	56	54	60	...	...	
31	30	28	...	6·00	42	41	37	2·50	...	56	66	53	...	...	60	70	60	0·70	...	
40	35	30	...	...	48	47	40	2·00	...	60	70	58	...	...	64	66	64	...	...	
27	34	28	...	9·00	42	64	44	...	...	68	84	56	...	...	60	18	60	0·20	...	
48	66	31	...	...	43	58	44	...	...	62	88	68	...	...	60	50	70	...	...	
34	38	38	...	...	40	48	43	...	...	62	78	56	...	...	58	64	58	...	...	
37	46	36	...	...	38	56	44	...	...	70	92	67	...	...	50	82	52	...	...	
35	30	22	...	2·50	36	47	43	...	...	76	76	66	...	...	58	92	60	...	...	
24	44	32	...	0·90	40	66	45	...	0·10	60	81	66	...	...	50	86	62	...	...	
36	42	46	...	...	35	42	36	0·60	1·00	62	74	60	0·20	...	66	78	62	...	...	
45	60	42	...	...	32	38	32	...	...	62	60	56	0·15	...	65	70	80	...	...	
38	56	34	...	...	30	48	34	...	...	56	58	49	0·05	...	58	60	54	0·20	...	
38	56	34	...	...	40	66	36	...	...	50	71	50	...	...	56	60	70	0·90	...	
30	66	46	...	...	...	...	...	...	...	54	72	62	...	...	...	...	...	...	...	
...	...	...	...	26·80	...	...	...	13·10	12·10	...	...	...	3·85	1·40	...	...	...	3·70	...	Fall each month of Rain and Snow.
19·48	34·39	22·45	...	...	34·43	47·90	34·33	...	...	52·51	66·64	50·19	...	...	58·66	67·86	60·10	...	...	Means of Temp.
25·44			...	...	38·89			...	...	56·44			...	...	...			...	...	Mean Temp. of each month.

APPENDIX

Abstract from Register of Temperature, &c., kept on the

1857.

Day of Month.	July.					August.					September.					October.				
	Temperature.			Depth in inches.		Temperature.			Depth in inches.		Temperature.			Depth in inches.		Temperature.			Depth in inches.	
	7 a. m.	2 p. m.	9 p. m.	Rain.	Snow.	7 a. m.	2 p. m.	9 p. m.	Rain.	Snow.	7 a. m.	2 p. m.	9 p. m.	Rain.	Snow.	7 a. m.	2 p. m.	9 p. m.	Rain.	Snow.
1...	70	72	70	0·40	...	64	82	76	...	...	60	84	70	...	...	33	51	40	0·07	...
2...	60	72	70	...	...	66	86	70	0·30	...	64	88	68	...	...	30	49	38	...	...
3...	64	70	72	...	...	64	90	74	...	...	66	82	68	...	...	32	54	49	...	...
4...	60	86	72	...	...	68	81	75	...	...	68	80	72	...	...	33	59	52	...	...
5...	70	74	78	...	...	63	78	68	0·10	...	68	76	56	0·40	...	43	57	48	...	...
6...	80	84	56	...	...	64	81	71	...	...	54	77	45	...	...	48	66	52	...	...
7...	70	72	65	...	...	65	88	73	...	...	45	64	45	...	...	43	58	42	...	...
8...	70	86	70	...	...	69	82	69	...	...	50	69	59	...	...	34	69	60	...	...
9...	72	86	70	...	...	70	84	67	...	...	60	73	64	0·15	...	50	60	48	...	...
10...	60	87	72	...	...	66	80	70	0·35	...	66	82	78	0·10	...	30	58	47	...	...
11...	70	99	70	...	...	70	80	55	0·05	...	70	62	58	0·15	...	33	66	53	...	...
12...	74	99	80	...	...	51	68	62	...	...	56	66	59	0·05	...	43	63	60	...	...
13...	72	99	80	...	...	60	76	70	1·20	...	60	81	64	0·05	...	49	63	51	0·06	...
14...	60	99	80	...	...	70	72	68	0·05	...	70	88	70	0 90	...	34	62	45	...	...
15...	60	85	70	1·30	...	65	77	62	...	...	60	68	58	0·05	...	38	56	50	...	...
16...	70	80	60	...	...	60	81	63	...	...	57	66	54	...	...	44	56	43	0·06	...
17...	62	80	72	...	...	59	84	57	...	...	50	61	50	0·30	...	30	49	44	...	...
18...	74	80	70	...	...	58	88	68	...	...	49	58	40	...	...	36	52	43	0·04	...
19...	60	82	72	1 00	...	69	70	64	0·40	...	42	70	50	...	...	40	45	34	0·36	...
20...	62	82	60	...	...	62	70	59	0·15	...	50	75	55	...	...	32	33	30	0·12	...
21...	70	82	72	1·10	...	59	73	59	...	...	45	64	47	...	..	30	36	33	...	...
22...	60	77	56	...	...	61	64	64	0·40	...	52	55	52	0·30	...	25	45	35	...	...
23...	64	80	70	0·60	...	64	68	62	0·15	...	58	56	48	...	...	31	53	44	...	...
24...	64	78	70	...	...	50	71	56	...	...	64	74	60	...	...	38	52	46	...	...
25...	69	83	73	...	...	57	73	63	...	...	64	82	64	...	...	32	58	48	0·08	...
26...	74	92	76	...	...	63	83	68	...	...	66	86	50	...	...	38	43	33	...	...
27...	72	90	82	...	...	59	80	69	...	...	58	82	77	...	...	27	45	43	...	...
28...	76	78	62	0·30	...	67	80	64	0·40	...	60	58	45	...	...	38	46	35	...	...
29...	66	76	69	...	...	60	72	53	...	...	45	50	43	0·55	...	34	40	36	...	...
30...	66	80	73	...	...	58	78	66	...	...	43	55	35	0·25	...	34	44	43	...	...
31...	68	85	70	...	...	56	69	58	...	...	...	...	⋮	...	...	37	47	43	0·05	...
				4·70	...	...	...	...	3·55	...	...	...	...	3·25	...	...	...	...	0.84	...
	67·29	83·06	70·39	...	...	62·48	77·76	65·26	...	...	57·3	71·06	56·80	...	...	36·09	52·58	44·13	...	...
		73·58		...	...		68·48		...	...		91·73		...	...		44.26			...

42·79 Mean Temperature of whole year 1857.

B.

Ottawa, between Fort William and Portage du Fort.

1858.

November.					December.					January.					February.				
Temperature.			Depth in inches.		Temperature.			Depth in inches.		Temperature.			Depth in inches.		Temperature.			Depth in inches.	
7 a. m.	2 p. m.	9 p. m.	Rain.	Snow.	7 a. m.	2 p. m.	9 p. m.	Rain.	Snow.	7 a. m.	2 p. m.	9 p. m.	Rain.	Snow.	7 a. m.	2 p. m.	9 p. m.	Rain.	Snow.
36	42	42	...	...	42	40	36	...	...	25	25	17	...	1·50	3	29	33	...	...
36	50	40	...	...	34	42	38	...	...	14	28	19	...	0·20	21	29	28	...	4·40
35	41	33	...	...	26	23	20	...	...	10	32	29	...	0·20	16	23	17	...	...
24	41	31	...	...	18	26	22	...	...	34	47	41	...	...	12	16	7	...	...
33	45	42	...	0·70	11	24	17	...	...	8	13	8	...	1·20	4	25	14	...	...
45	60	46	0·22	...	9	19	25	...	0·10	5	17	11	...	...	17	26	30	...	...
38	50	48	...	...	35	44	35	...	...	...	11	3	...	...	25	31	24	...	1·00
43	44	42	0·23	...	32	42	31	...	...	17	19	15	...	...	1	15	1	...	...
46	56	42	0·61	...	32	31	37	0·20	...	13	32	27	...	...	6	19	16	...	2·50
36	43	35	0·73	...	34	31	15	...	...	5	31	20	...	...	9	12	4	...	..
34	40	32	...	...	12	16	10	...	...	28	39	41	0·18	...	19	1	7	...	...
33	40	33	0·03	...	5	30	28	...	...	13	21	7	...	...	18	14	3	...	...
34	32	28	0·10	...	27	40	39	...	...	9	23	29	...	0·20	25	10	4	...	...
19	27	23	...	...	36	37	35	...	...	8	39	27	...	...	...	14	7	...	0·40
26	38	35	...	...	12	28	28	...	...	14	23	22	...	...	10	12	2	...	...
31	39	32	...	...	28	36	34	...	0·20	28	31	15	...	1·20	9	12	2	...	...
33	35	33	...	1·00	33	44	37	...	...	1	10	...	...	...	14	6	1	...	...
30	33	32	...	1·40	36	33	22	0·70	...	2	18	3	...	...	9	4	1	...	...
34	42	37	0·14	...	10	12	7	...	...	6	24	16	...	...	20	12	...	...	...
24	26	22	...	...	8	22	17	...	...	14	32	28	...	...	9	18	12	...	...
19	30	32	...	0·30	18	32	30	...	...	12	34	16	...	...	14	27	16	...	...
28	25	24	...	...	26	29	22	...	2·80	9	20	4	...	...	5	10	2	...	...
24	28	16	...	4·20	21	30	30	...	0·80	6	27	14	...	...	18	24	5	...	...
16	16	2	...	1·50	8	11	4	...	...	8	32	31	...	...	8	32	27	...	...
3	13	12	...	...	6	12	4	...	...	34	39	38	0·10	...	25	31	22	...	...
15	26	27	...	...	8	16	12	...	...	40	46	38	0·09	...	18	40	32	...	...
15	40	36	...	...	6	18	12	...	...	18	17	14	...	...	32	44	38	...	...
35	46	38	...	...	26	36	32	...	...	11	19	22	...	...	33	31	28	...	...
38	41	37	...	...	20	30	26	...	...	22	24	25	...	...					
34	40	44	0·20	...	22	29	27	...	0·70	9	11	3	...	...					
...	...	...	...	...	30	31	28	...	4·50	10	5	3	...	...					
...	...	...	2·26	9·10	...	...	...	0·92	9·10	...	...	...	0·37	4·50	...	...	...	...	8·50
29·70	37·63	32·53	...	...	21·19	28·84	24·52	...	...	10·74	25·45	18·97	...	...	...	...	...	...	...
33·29			...	...	24·85			...	...	18·39			...	...	...	...	...	...	...

NOTE.—This Register ends with February, when the Ottawa Survey was stopped.

Fall each month of Rain and Snow.

Means of Temp.

Mean Temperature of each month.

APPENDIX

Summary of Means, &c., of preceding Registers

Year.	Month.	Upper Matawan Register.						Lower Matawan Register.					
						Depth in inches.						Depth in inches.	
		7 a. m.	2 p. m.	9 p. m.	Mean.	Rain.	Snow.	7 a. m.	2 p. m.	9 p. m.	Mean.	Rain.	Snow.
1856.....	November	27·27	32·50	28·63	29·47	2·60	8·40	26·73	34·13	28·27	29·71	2·50	16·30
	December.....	5·89	14·53	8·81	9·74	0·20	23·10	4·97	14·87	9·39	9·74	0·30	24·40
1857.....	January	5·15	6·27	3·87	0·92	...	4·85	8.06	8·35	1·02	0·25	...	13·10
	February	14·54	24·30	19·34	19·39	2·00	0·90	13·57	24·86	19·07	19·17	0·90	12·20
	March	11·74	30·87	17·82	20·14	0·10	14·40	9·94	32·13	18·23	20·10	0·04	11·90
	April	28·07	43·08	28·12	33·09	1·00	8·55	26·13	42·60	28 20	32·31	2·20	7·40
	May	44·11	62·10	43·94	50·05	1·81	5·70	...	...	...	...	...	...
	June	...	...	...	...	...	...	...	...	...	...	...	...
	July	...	...	...	...	...	...	...	...	...	...	...	...
	August	...	...	...	...	...	...	...	...	...	...	...	...
	September	...	...	...	...	...	...	...	...	...	...	...	...
	October.....	...	...	...	...	...	...	...	...	...	...	...	...
	November	...	...	...	...	...	...	...	...	...	...	...	...
	December.....	...	...	...	...	...	...	...	...	...	...	...	...
1858.....	January	...	...	...	...	...	...	...	...	...	...	...	...
	February	...	...	...	...	...	...	...	...	...	...	...	...
Total Rain and Snow for seven months						7·71	74·90	...	...	...	...	...	...
Total Rain and Snow for six months						...	...	...	...	...	...	5·94	85·30
Total Rain and Snow for whole year 1857						...	...	...	...	...	...	...	...
Mean Temperature of year 1857, shewn by Register kept on the Ottawa between Fort William and Portage du Fort						...	...	...	...	...	...	...	...

B.

of Temperature, &c., on the Ottawa Survey.

Fort William to Portage du Fort.						Mean Temperature, shewn by the three Registers.			
				Depth in inches.					
7 a. m.	2 p. m.	9 p. m.	Mean.	Rain.	Snow.	7 a. m.	2 p. m.	9 p. m.	Mean.
26·37	36·60	29·37	30·78	1·25	13·10	26·79	34·41	28·76	29·99
4·58	15·54	9·00	9·70	0·20	33·80	5·15	14·98	9·07	9·73
6·74	13·00	2·49	1·26	...	8·30	6·65	9·21	2·46	0·03
18·25	31·32	19·71	23·09	2·10	10·70	15·45	26·83	19·37	20·55
19·48	34·34	22·44	25·44	...	26·80	13·72	32·46	19·50	21·89
34·43	47·90	34·33	38·89	13·10	12·10	29·54	44·53	30·22	34·76
52·51	66·64	50·19	56·44	3·85	1·40	48·31	64·37	47·06	53·25
58·66	67·86	60·10	62·20	3·70	...	.....	.....	.....	.....
67·29	83·06	70·39	73·58	4·70	...	.....	.....	.....	.....
62·48	77·70	65·26	68·48	3·55	...	.....	.....	.....	.....
57·33	71·06	56·80	61·73	3·25	...	.....	.....	.....	.....
36·09	52·58	44·13	44·26	0·84	...	.....	.....	.....	.....
29·70	37·63	32·53	33·29	2·26	9·10	.....	.....	.....	.....
21·19	28·84	24·52	24·85	0·92	9·10	.....	.....	.....	.....
10·74	25·45	18·97	18·39	0·37	4·50	.....	.....	.....	.....
3·74	20·18	11·89	11·74	...	8·50	.....	.....	.....	.....
.....	.....	.....	.....	...	...	.....	.....	.....	.....
.....	.....	.....	.....	...	...	.....	.....	.....	.....
.....	.....	.....	.....	38·27	77·50	.....	.....	.....	.....
37·55	51·00	39·83	42·79	...	...	.....	.....	.....	.....

APPENDIX C.

DATES of opening and closing of Navigation on the Erie and Welland Canals, and on the Upper Ottawa.

Opening.				Closing.			
Year.	Erie Canal.	Welland Canal.	Upper Ottawa.	Year.	Erie Canal.	Welland Canal.	Upper Ottawa.
1847..	.....	.....	May 6	1847..	.....	.....	November 23
1848..	.....	.....	April 18	1848..	.....	.....	" 18
1849..	.....	.....	" 24	1849..	.....	.....	" 29
1850..	April 22	April 1	" 30	1850..	December 5	December 12	" 30
1851..	" 15	March 25	" 17	1851..	" 5	" 12	" 25
1852..	" 20	April 13	May 1	1852..	" 15	" 14	" 30
1853..	" 20	" 1	April 26	1853..	" 15	" 17	" 62
1854..	May 1	" 3	" 29	1854..	" 3	" 4	December 1
1855..	" 1	" 16	" 27	1855..	" 15	" 12	Novemb'r 27
1856..	" 5	" 26	" 29	1856..	" 3	" 13	" 30
1857..	" 5	" 15	" 30	1857..	" 10	" 15	" 24
Average	April 26	April 9	April 27	Average	December 9	December 12	Novemb'r 27